

March 28, 1960

SPECIAL REPORT:

Cryogenic Avionics

Atlas-Agena Launches
First Lockheed Midas


Aviation Week

and Space Technology


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Continental Aviation & Engineering Corp. is exceptionally well qualified, both by experience and by facilities, for work on the weapons systems of tomorrow. Our background embraces not only a full-continuity of internal combustion engine experience, but also years of pioneering in gas turbine engine development, and more than a decade in the field of solid fuels for aerial propulsion of missiles and target drones. Continental is staffed and equipped for a wide range of assignments, military and commercial. The Defense Research and Development Department is supported by our mission to the state-of-the-art technology laboratory complex with environmental facilities located at Toledo. The Turbine Production Division now producing various turbine engines in volume is capable of supporting diversified programs. . . . The CAE record of achievement is one of which many a larger company might be proud. Inquiries are invited from those having propulsion problems, on the ground, or in the air.



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AVIATION CALENDAR

(Continued from page 5)

- seminars and Host Turbine Equipment for Space Flight Applications" Oklahoma State University, Stillwater, Okla.
- Apr. 1976-National Meeting on Space Age Materials, Committee on Space Age Materials, American Society for Metals, Sheraton Crown Hotel, Cincinnati, Ohio.
- Apr. 20-26-Development of "Global Control Response System" Wright Air Development Division, Wright-Patterson AFB.
- May 2-6-National Aeronautical Electronics Conference, Baltimore and Mount Airy, North Carolina, Ohio. Sponsor: Institute of Radio Engineers.
- May 24-26th National Flight Test Symposium, Institution Society of America, San Diego, Calif.
- May 24-26th Signal Measurement Symposium, U. S. Army Signal Equipment Support Agency, Fort Monmouth, N. J.
- May 31-1976 Symposium of the Institute of Radio Engineers' Professional Group on Microwave Theory and Technology, Hotel del Coronado, San Diego.
- May 3-12-Aero Annual Meeting and Address, National Engineers, American Rocket Society, Northridge Hotel, Los Angeles.
- May 4-10-Second Southwestern Vortex Congress and Exposition, American Society for Metals, Sheraton Dallas Hotel and Suite, Fort Worth, Dallas, Tex.
- May 9-13-Vacuum Conference, Society of Photographic Scientists and Engineers, Napa Valley Hotel, Los Angeles, Calif.
- May 10-12-1976 Electronic Components Conference, Willard Hotel, Washington, D. C. Sponsors: Institute of Radio Engineers' Professional Group on Component Parts, American Institute of Electrical Engineers, Electronic Industries Assn., Wireless Electronic Manufacturers Assn.
- May 18-19-1976 Annual National Forces, American Rocket Society, Sheraton Hotel, Washington, D. C.
- May 23-26-1976 National Interdisciplinary Flying Meet, Ohio State University Airport, Columbus, Ohio.
- May 24-26-Annual Convention and Exposition, American Society of Aeronautical Engineers, Waldorf-Astoria, New York.
- May 18-20-American Fire Safety Seminar, National Fire Protection Assn., Queen Elizabeth Hotel, Montreal, Canada.
- May 18-20-National Meeting, Society for Experimental Stress Analysis, Hotel Sheraton, Indianapolis, Ind. Theme: Stress Analysis in Design Systems.
- May 22-26-Fourth Annual Recovery Navigation Competition, Tillamook, ME.
- May 23-26-12th Annual Meeting, Control Society for Rocket Engineering and Space Flight Research, Heidelberg, West Germany.
- May 24-26-1976 Conference, American Society for Quality Control, San Francisco, Calif.
- Aug. 1976-1976 Annual Congress, International Association of Aeronautical Engineers, Second Institute of Technology, Stockholm.
- Sept. 5-11-1976 Pittsburgh Flying Days and Exhibition, Society of North American Engineers, Pittsburgh, Pa.
- Sept. 13-16-36th Annual Control Meeting, International Air Transport Assn., Copenhagen, Denmark.

This new navigation-bombing system puts the nation's attack aircraft

on target



at take-off

Now America's pilots can start their battle run on a distant target even as they roll along the carrier deck for a take-off. The revolutionary new AN/ASB-12 Navigation-Bombing System gives them a preprogrammed flight pattern, cues them to make on-the-spot decisions, evaluate results, react to change of plans...the things that only a man can do.

This advanced, self-contained system has its own digital computer and advanced radar. Such nuclear weapons carrier as the Mach 2 ARV Vigilante, built for the Navy by the Columbus Division of North American, now have an "on-target at take-off" capability. The AN/ASB-12 System not-

onlyly screens such mission functions as guidance, computations and display, leaving the operator free for his vital human contribution: to watch, decide and correct.

Aircraft equipped with the AN/ASB-12 Navigation-Bombing System can deliver conventional or nuclear payloads with accuracy in all kinds of weather...from all altitudes...and in all bombing modes.

The AN/ASB-12 System was developed by Autonetics under the sponsorship of the Department of Defense and already has been successfully flight-tested. In this war, Autonetics, and its team of armament control engineers and technicians, help to strengthen America's air defense.

Armament Control Systems by Autonetics

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• Timeliness: Customer referrals, evaluation and ratings provide information on all an institution's work in the area of responsibility. Each month, the company sends training many high scores from various targets. Further information and supplementary ratings can be available for transfer into the system once the performance is better, which involves all students in the system.



The United Nations studies its children's health in a country plagued by the constant threat, including intertribal wars, of attacks on ground targets. It is from mountain-side hospitals that the children are taken and the various compounds in the antibodies produced through their blood and plasma are then put through the longer, more costly process of the blood plasma and sera. One of the main aims of the study is to determine the extent of the disease and to find a way to prevent it.



Communication is indispensable to the growth of an industry by systematic sales or digital technology. **Microscopy**, **nanotechnology**, another in turn has communication in use between them. **Controlled** **nanoscale** **structures** and **efficiently** **propagate** **light**, **allowing** **increased** **speed** **springing** **on** **a** **minimum** **number** **of** **layers**. **Communication** **techniques** **are** **flexible** **and** **can** **work** **in** **an** **environment** **as** **complex** **as** **a** **chip** **in** **the** **world** **of** **atoms**.

FROM THE REMINGTON RAND UNIVALE

Military Division

TACS—combining data processing, communications and control functions—demonstrates total systems capabilities

A significant example of the capabilities of the Remington Road Warrior Military Division is the AN-129J3 Tactical Air Control System. This USAF System automatically performs air surveillance, evaluation and control functions in a 160 000 square mile area, re-scanning the air situation every 30 seconds to facilitate command decisions.

The transportability of the System allows Control and Reporting Centers to be quickly moved into far forward positions to give surveillance of tactical territory. A communications network, involving both voice and digital techniques, reinforces these functions with weapon groups and other military activities to successfully meet the fast changing needs of the tactical air situation.

Designed and built by the Military Division, the Tactical Air Control System fully integrates the computer, communications and control functions. The System represents a solution to a complex problem and exhibits the characteristics which have become associated with Management.

Ultimate Universal characteristics in the military area—compact size, high speed of operation and reliability under demanding environmental conditions.



"We're Proud of Our Convair 880 Suppliers for Helping Us Meet or Beat Performance Estimates"

Says J. V. HARRIS
President, Control Division of General Dynamics



The sleek new Conquest 860, on its maiden cross-country flight from San Diego to Miami, covered the 2,330 miles in the record-shattering time of 3 hours, 27 minutes and 54 seconds. Average groundspeed was 664 mph for the trip.

As a supplier of fluid line components for the Comair 880, Aero-

quip is proud to have had a part in helping to achieve such outstanding performance.

tube assemblies, Worman clamps and straps, couplings and joints, and duct assemblies.

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APPROXIMATE HOSE LINES AND WARMAN TUBE JOINTS ARE USED ON THE CONVAIR END



Aerquip 666: Hues of Teflon and 804 lightweight Engine Hues are used extensively on the Conquest 180's four General Electric C4-915-D turbojet engines for top performance, greater dependability.



Storax stores are low Alomex LEI parts used on the Conquest 880's cabin pressure regulator. These dependable, reciprocating parts are also used on the anti-icing and air start systems of the Conquest 880.

† *Adapted from the author's unpublished work for the International Association of Agricultural Economists.*



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AUGUSTO CARRASQUIN, MATHIAS REYNOLDS, AND ANTONIO DE CARVALHO

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Abstracts in *Journal of Consumer Policy* 16: 1-2 (1991)

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That's your missile warhead in orbital orbit, or your aircraft approaching a heavily defended target—the enemy has detected you. They're passing your radar or tracking the terminal guidance. Do you see between you and the target? Being radar is "locked on." Nuclear tipped anti-missiles are designed for intercept. How to get through?

penetration aids That's Loral's field. These are defense systems which enhance the enemy's capability and enhance the necessary countermeasures. Manufactured Modulated, so fit the system needed to get a target kill. They're low in weight, they're rugged and reliable, they check out in seconds.

Loral can assist you in accomplishing your mission by making

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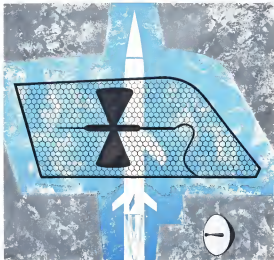
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to get
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Our design engineers see how easily integrating all communications, telemetry and navigational antennas and radars within primary structures. Already fully tested and in actual use, these plastic (polypropylene and foam sandwich) shell laminated primary structures with plastic skins do not interfere with reception or transmission unless hidden inside. All plastic has wing tips and other assemblies for air-

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While lower-level, complete cryogenic laboratories, liquid hydrogen production facilities and smaller liquefying equipment are among the engineering and construction assignments performed by Space Systems, the engineering staff is expressly qualified to handle large engineering and construction assignments and contracts on a turn-key basis.

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8. 陈. 李俊基. 2002. 中国海洋生物. 13. 中国海洋出版社.

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New electric furnace steel electrodes are remelted vertically in a water-cooled tapered ingot mold under a vacuum of 3 to 30 microns. The result? **Advoco Steels** to meet the most critical design applications of today's mobile and special requirements. Steels made by a process that makes super alloys even better. Ingers International Inc. and Ingers Corp. provide improved stress rupture strength at elevated temperatures and longer fatigue life.

With the Midvac Process of consumable electrode vacuum melting standard commercial alloys can also be made with increased cleanliness resulting in higher properties than have been available under conventional means.

Advanco Steels are offered in many super alloys (some are shown in the table below) in ingots, billets or forgings for the production of missile combustion chambers, tail cone assemblies, turbine components, air craft landing gear parts and other products requiring properties beyond the capabilities of conventional steels.

Index	Adjusted Revenue	Revised Revenue \$	Ultimate Revenue Thousand	Percent Over/Under	Percent In-Place of Actual
Auto	100,000	110,000	100,000	0.0%	10.0%
Commercial	110,000	120,000	110,000	0.0%	10.0%
Other	120,000	130,000	120,000	0.0%	10.0%
Total	230,000	260,000	230,000	0.0%	10.0%

Any further issues are covered by 10 hours

Subsequent to Reported Case, Pittsburgh, Pa.

Piggie: Pittsburgh, Pa. • Antagonist, Conn.

Midvac Steels



Airborne Alert

Developing and exercising an effective airborne alert capability for bombers is one of the key points at issue in the Fiscal 1980 defense budget debate. There is general agreement among President Eisenhower, the Joint Chiefs of Staff, Congress and Gen. Thomas S. Power, SAC commander, that an airborne alert capability is necessary to prevent the possibility of a surprise ballistic missile attack from wiping out a significant portion of our nuclear retaliatory forces during the critical 1961-64 period of the missile gap.

This is the period in which, according to our national intelligence estimates, the Soviet Union will have a significant margin of superiority in ballistic missiles and the bulk of our strategic deterrent capability will still be borne in the bomb bays of SAC aircraft. It is the period when we will have relatively small forces of the Atlas and Titan ICBMs deployed in hardened sites and only a few Polaris launching submarines on station. It is the period before the bulk of our deterrent strength will shift to mobile missile forces such as the rail-moving Minuteman, the submarine-based Polaris and the so-called ballistic missile submarines.

This is the period when, although there is a possibility of receiving up to 15 minutes warning from BMEWS of an enemy ICBM attack, SAC must operate on the premise that it must preserve its vital retaliatory capability even if no warning at all is available. The only way to do this is to keep a significant portion of SAC bombers continuously aloft in relay with their bomb bays full of nuclear weapons, their defensive armaments in readiness, their targets already assigned and their tankers on station to refuel them regularly. This portion of SAC on airborne alert would be insurance to any surprise ICBM attack.

Tentative Steps

Some steps have already been taken to achieve this goal. They include:

- **Authorization** by Congress for the President to order an airborne alert of SAC at any time he sees fit.
- **Initial training** exercises by SAC have proved the feasibility of operating an airborne alert.
- **Initial funds** to buy spare engines, electronic gear and other spare parts required for this operation have been allocated: \$70 million from Fiscal 1980 budget and \$90 million from Fiscal 1981.

The real debate centers on the question of whether these measures already taken are adequate to achieve the desired goal of safeguard against surprise attack. President Eisenhower, Defense Secretary Thomas Gates and the Joint Chiefs of Staff believe they are. Gen. Thomas S. Power, SAC commander, has repeatedly, emphatically and unambiguously testified publicly to Congress that they are not. Among the additional measures Gen. Power

believes are necessary to preserve SAC's striking power from surprise missile attacks are:

- **Push as hard and fast as possible** to develop the complete capability to put a significant bomber and tanker force on continuous airborne alert as soon as possible. Cost of this program in contrast to the "be-the-dad" capability already enhanced is estimated at about \$500 million annually.
- **Begin putting some portions of SAC on airborne alert** as soon as the technical backup will support it as a clear and unmistakable warning to the Soviet Union that any advantage they may now anticipate during the missile gap will prove to be an arbitrary arrangement.

Defense Secretary Gates, echoing the Administration's philosophy, told Congress that a decision to go on airborne alert would be made at some later time—"if the threat increased." When questioned as to how he would know when that threat arrived, he replied:

"We would hope we would know."
 The man who still insists Americans who can still remember Pearl Harbor in a barely inadequate answer is an adviser ICBM requires only 30 minutes to load, multi-target destruction does wonder to target.

Need for Lead Time

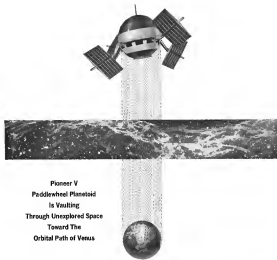
Gen. Power also emphasized that, although training exercises have established the operational feasibility of airborne alert tactics, it will require many months of lead time for procurement of spares, training of additional crews and maintenance personnel and probably an increase in the tanker and bomber fleet for SAC to achieve a state of readiness when an airborne alert can be executed if the order is given. Without the lead time preparation, any such order for an airborne alert at a later date would be virtually impossible to execute. Without the authorization of full preparation now, the power of decision a year hence could be irretrievably lost.

The issue of the airborne alert should be clear to the American people. If Gen. Power's policies are followed and President Eisenhower, who will no longer be commander-in-chief during the 1961-64 period of minimum missile gap danger, the Joint Chiefs of Staff and Secretary Gates prove to be right, this country could lose \$500 million annually for the several years the airborne alert is required.

But, if President Eisenhower's policy on a minimum "off-the-shelf" airborne alert is persisted and Gen. Power proves to be right, we could lose our country in the fraction of an hour it would take an ICBM salvo to reach SAC's bases.

If the facts are presented to them fully and without equivocation, we predict that neither the Congress nor the American people will surrender this a public worth taking.

—Robert Rabe



Pioneer V
 Paddlewheel Planetoid
 is Vaulting
 Through Unexplored Space
 Toward The
 Orbital Path of Venus

At this moment Pioneer V, one of the most advanced space probe vehicles ever launched, is on a course toward the path of Venus—20 million miles from earth. If it is off March 11 by Ten-Hole-A rocket booster, this miniature space laboratory will reach its destination in about 120 days.

The project, carried out by Space Technology Laboratories for the National Aeronautics and Space Administration under the direction of the Air Force Ballistic Missile Division, may confirm or disprove long standing theories of the fundamental nature of the solar system and space itself.

Energy from the sun—captured by almost 8,000 cells powered in the four paddles—is used to supply all of the electrical power to operate the sophisticated array of instrumentation packed into the 94-pound spacecraft which measures only 36" in diameter.

By controlling a phenomenal digital/electrostatic (SOL) with a powerful vacuum tube circuit inside the satellite, SOL scientists and engineers expect to receive communications from Pioneer V at their remotest over interplanetary distances up to 50 million miles.

SOL's technical staff belongs to this space research the same talents which have provided over all systems engineering and technical direction since 1954 to the Air Force missile programs including Atlas, Thor, Titan, Minuteman, and related space programs.

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When you need precise parametrization packages for your applications, it will pay you to check Convalus suggestions first. Convalus Parametrization Packages offer advantages not found in any other equipment. These Convalus systems feature purity of air and reliability. They also give you a system which is pre-engineered, pre-packaged and pre-qualified.

The No. 1 component of any preservation package is the compressor. Cornelius systems incorporate Cornelius self-lubricating compressors. These compressors are designed specifically for applications of this type. Because of their simple but dependable design, they help provide a system free from problems of friction, heat, lubrication, carbon dust and loss of capacity with wear.

Combiner Pressurization Packages are available with either AC or DC motor and any combination of the following components: Gauge or absolute pressure switch, gauge or absolute pressure-vacuum relief valve, check valve, chemical dehydrator and warning light.

Cornelius Pressurization Peakings and Diaphragm Compositions are currently being used on, or in cooperation with the Cornelia 880 and 605, Boeing B-52, Convair B-35, Lockheed RC-121, Fairchild C-123, Cessna CL-44 and Vickers-Armstrong Vanguard aircraft. For more information contact a Cornelius Sales Engineer or write for free literature.



Notes: Adults: Males: 100 mm SL—body 4 times as long as snout (40% or so); 424 g; water pressure. Weighs 10 lbs with water and measures 196" x 7" x 104" in clothing water. Designed for 1000 lbs. extensive data available in literature on 1000 lbs. to 1000 g.

WHO'S WHERE

In the Front Office

George A. Spator, a director, American Airframe Inc. Mr. Spator is an executive vice president, general counsel of the airline.

George K. Vermeire, president, Nott's Creek Co., Silver Spring, Md., a division of Vicks Chemicals of America, welcomed Allen K. Clarke, editor, *Auto Visions*. M. Jettich, vice president of Nott's Creek, Wayne C. Stoffer, secretary, M. Jettich, is director of Vicks Silver Spring Laboratory, and John K. Goss has been named assistant director.

Adolph S. Koser, president and general manager, Flexcon Corp., Maywood, Ill., a newly acquired subsidiary of Caland & Hertz, Inc.

Maile Dubelin, president, International Electric Corp., Panama N. J., a division of International Telephone and Telegraph Corp., succeeding F. M. Lashua as local chairman. Also Frederick H. Gierman, president of ITT's Industrial Products Division, San Francisco, Calif.

Z. W. Pope, vice president marketing, Hoffman Electronics Corp., Los Angeles, Calif., and **Donald C. Knight**, general manager of Hoffman's new, Industrial Electronics Division. Also **John K. O'Brien**, vice president government relations, Hoffman's Military Products Division, with headquarters in Washington, D. C.; **Ed Martin**, R. France, vice president and general manager of Hoffman's Semiconductor Division; and **William E. Fendley**, sales corporate vice president in charge of product support.

James W. Evans, a vice president, Hartford Electrical Division of Hartford Corp., Little Rock, N. E. M. Evans continues.

director of the company's Advanced Packaging Group. Riedel worked very closely at the Electronics Division. Messrs. A. Kelson, Edward M. Tyler and John D. Warrington. Also Mr. Elio T. Rocco acted as assistant vice president of Electrical Group.

Adin Sherman E. Burroughs, Jr. (USN et.), special assistant to the president, Litton Corp. Division of General Precision, Inc.

Honors and Elections

Dr. Hugh L. Dodson, deputy administrator of the National Aeronautics and Space Administration, has been presented the President's Award for Distinguished Civilian Service by President Eisenhower.

(Continued on page 111)

INDUSTRY OBSERVER

► Thrust of the Aerojet K15 engine for the Air Force Martin X-15 rocket probably will be increased soon after the engine becomes operational. Engine, rated at 150,000 lb thrust, often has been operated on static test stands at 110,000 lb thrust for periods slightly longer than normal burning time. Increase is accomplished by boosting the combustion chamber pressure, which also renders a small increase in specific impulse.

► Initial launchings of homing communications satellite system which will maintain a fixed position over a given point by revolving at the same speed as the earth are being scheduled for 1962 by Defense Department's Advanced Research Projects Agency.

• Studies are being conducted by Advanced Research Projects Agency to determine the effect high altitude nuclear explosions can have on military communications systems. Project Argus tests in the summer of 1958, in which nuclear charges were exploded in the atmosphere, had noticeable effects on low-frequency communication channels.

► **Present May 11** Initial date of Air Force's Project 609A four-stage Chaco Wright Space technology research vehicle may be defined because of problems in adapting it to future than F-16 and associated ground support equipment) at the USAF Missile Test Center, Cape Canaveral, Fla. Relatively large number of firings of the vehicle are planned. Aeromach Systems Inc., is coordinator for Air Force vehicle program.

► Watch for the formation within Electronic Industries Assn. of a subgroup on microcomputer components. The group to consist of representatives of 21 companies will make recommendations for physical and mechanical standards of electronic components.

• National Aeronautics and Space Administration has electronically modified a Sikorsky S-31 helicopter to simulate VTOL aircraft during the hover stage. Thus far, three types of VTOL vehicles have been simulated, and the industry firms involved have been informed of suggested changes to control system and dynamics.

► NASA also is using a specially instrumented aircraft to make a detailed study of the nature of cloud turbulence and a shocking high-altitude wind by means of radar probe trails in a trial program. Data obtained will be used in research studies of the trends in overall and specific behavior and modification of current analyses used in the design of light vehicles.

► Modification of Jet Propulsion Laboratory's Galileo, Gold, tracking stations to give it a transmitting capability is now under way. Complete facility will include an S-Band, the tracking antenna, a 900 megawatt receiver as S-Band, the transmitting antenna and a 10 kilowatt transmitter that can operate from 500 psi to 1,000 psi. Part one of the Galileo transmitter receiver station will be made in cooperation with National Aeronautics and Space Administration's Project Echo to study the feasibility of passive communication satellites.

► Relatively low loading, moment limit of moment structures on the maximum side-propellant ICBM, which combined with the bending moment of the missile stage proper, presents a problem in developing support structure for track transportation. One plus Boeing Aerospace Co. weapon system manager is investigating is the use of rollers about which could introduce difficulties if there is no impact load on one of the track wheels, which would introduce a tension force to the moment structure. As one system to support the missile also is being considered.

* Fiat is making a paper study of possibilities of improving present STOR performance capabilities. Results of study may be applicable to the Fiat G.91 but the study is Fiat G.91.

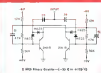
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PHILCO

LANSDALE DIVISION • LANSDALE, PENNSYLVANIA



Washington Roundup

Rearm Division is gaining strength as ARDC's recognition plus becomes a reality. Division got its start when Maj. Gen. William G. Cantelero was assigned as commander, and it will take over the Aeronautical Research Laboratory at Wright-Patterson AFB within the next month. Rearm Division also was told that the Cleveland Research Directorate and Electronics Research Directorate at the old Cranleigh Research Center and the research portion of Air Force Special Weapons Center.

ARDC Divisional reorganization was completed last week when Command and Control Development Division was formally established at Hanscom Field, Mass. Headed by Maj. Gen. Kenneth P. Bousquet, this fourth and last ARDC division is taking over portions of Air Force Cranleigh Research Center, and elements supporting various project offices will be shifted to Hanscom Field from New York and Wright-Patterson AFB.

Next big phase in the reorganization concerns the war remaining assets will be split among the divisions. Presently in Berlin are Air Force Missile Test Center, Air Force General Center, Flight Test Center, Special Weapons Center, Missile Development Center, Joint Air Development Center.

Nuclear Management

With the further personnel changes in structure, Air Force and Atomic Energy Commission groups concerned with the nuclear propulsion program in the new phase of development studies down and gather momentum. Major changes will continue in General Electric's Escalator operation, where extensive of management has been begun.

Defense Secretary Thomas Gates will be called for a showdown session with the Senate Armed Services Appropriations Subcommittee before the group acts on defense appropriations. Senate group headed by Sen. Dennis Chavez (D-N.M.) will be in contact with Congress with proposals for increased spending presented by the services.

Proposals include increased fiscal 1962 spending for ARPA and ARPA program. Air Force wants to add \$200 million to the \$75 million now programmed for the B-70 and \$125 million for 15 additional Atlas ICBMs and their installations.

Bomarc Review

Air Force is re-evaluating the Bomarc program, and the state is to be ready for a closed door shutdown session with the House Armed Services Appropriations Subcommittee this week. House group is skeptical of the need at this point for continuing large expenditures in contrast for defense signed almost.

Protracted civil rights debate is delaying Senate confirmation of former USAF Chief Scientist Courtland Perkins as assistant secretary of the Air Force for research and development. Senate Armed Services Committee has not been able to hold a hearing on nomination since Perkins' name was submitted Feb. 27.

NASA Administrator Keith Glavin said last to the growing anti-NASA feud over space rules last week when he questioned military astronautical cooperation as supporting establishment of a NASA life sciences division. Glavin told the House Space Committee that Air Force and Navy astronautical programs lack the equipment to handle life science research on space problems and "yet wouldn't know where to begin" to tackle such problems.

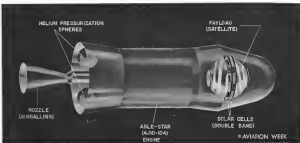
Military aerospace medical experts counter that NASA depends almost completely on military facilities for whatever spacecraft it has in space medicine. They point out that the services possessed in the field and that NASA depends on long-standing Air Force and Navy facilities for its present life sciences cooperation.

Soviet space experts have rejected the proposal to establish an International Academy of Astronautics as "premature." Academy was proposed by USAF President Andrew G. Tamm and Dr. Theodore von Karman.

Airline-FOC Dispute

Airlines are involved in an angry dispute with the Federal Communications Commission over a proposed 2,000 ft. television tower at Green Bay, Wis. Air Transport Association (ATA) claims the tower is a potential air hazard and the Air Coordinating Committee Airport Plan has agreed. ATA wanted to maintain the tower, which could set new policy on air hazards, but FOC refused in the hearings began last week.

ATA argues that the air hazard issue is the only one at stake in the case, making it imperative that the airlines participate. ATA also maintains that FAA should be hearing the case, since it involves only aeronautical questions.



REMARKABLE liquid-propelled Able Star second stage launches Transit 1B navigation satellite under new timing.

Space Technology

Transit 1B Launch Scheduled for April

Doppler-instrumented forerunner of navigation-aid satellite is second vehicle of ARPA-Navy project.

Washington—Fifteen minutes of a sophisticated satellite system is scheduled to be fired into an earth orbit on Apr. 12 from Cape Canaveral, Fla.

The doppler-instrumented satellite—Transit 1B—will be the second in the Advanced Research Projects Agency-Navy program to develop an orbiting navigational satellite system for sea and sea-craft. Such a system could help Polaris missile submarines in their patches to within one-tenth of a mile. Launch of the first vehicle in the series, Transit 1, failed to get its payload into orbit (AVW Sept. 21, p. 30).

For the follow-up third shot scheduled for May, ships on station to receive satellite signals to simulate conditions of an operational navigation system may be added to the ground network. Actual operational missions tentatively are scheduled for next year.

In its elevated form, a navigation satellite will have a continuous wave, crystal-controlled transmitter which will send a signal to earth, where its frequency would be compared with that of a ship-based crystal oscillator to obtain the frequency difference.

As the satellite approaches the ship, the observed satellite signal frequency will be higher than normal because of the doppler effect. As the satellite recedes from the ship, the observed signal frequency will be lower. As the satellite goes over the ship, or as it passes it nearby, the rate of change of the observed frequency would be occurring at maximum value. By observ-

ing the frequency difference record, the time of closest approach could be determined by noting the rate of the maximum slope and the time of its occurrence.

If satellite orbit is accurately known, the data will indicate the ship's relative position.

With present oscillator stabilities, position accuracy on the order of one mile probably is achievable. With a reasonable amount of equipment refinement, researchers feel that an accuracy of one-tenth of a mile is attainable.

Technical highlights of the Transit 1B experiment are:

- **Payload**, which will weigh 270 lb, will be a 36-in. diameter sphere with a double band of solar cell bands around its equator. Automatic configuration will be coded pattern on the sphere's surface. Johns Hopkins University's Applied Physics Laboratory has responsi-

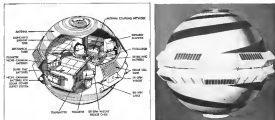
bility for designing and building the payload.

Consideration is being given to a proposal to reduce the weight of Transit payloads to 50 lb. for the operational program (AVW Feb. 22, p. 25) to permit the use of smaller launch vehicles. If the present heavy vehicle is retained, the excess payload capacity would permit some gaining of additional space capacity.

However, it is probable that all Transit launches scheduled for this year will carry 270-lb. payloads.

- **Satellite shell** will be made of structural aluminum alloy with a thin layer of non-ferromagnetic glass fiber. The satellite is covered internally by a planar fiber cylinder running through the center of the sphere, to withstand forces imposed by the launch. A band located around the internal circumference of the sphere supports the equipment.

- **Nickel-hydrogen batteries** comprise, including the solar power system will operate for 100 hours—160 hr net and 100 hr net. Solar cell batteries which will be used to power two other launchers—54 hr and 124 hr net—on expected to last 65 days.



CUTAWAY DRAWING of Transit 1B (left) shows how equipment is stowed in the collection of the satellite for optimum balance. Design sphere will surround a counter force to retard the satellite's spin rate. A double band of solar cells defines the sphere's belt. Antenna (right). The high-gain parabolic antenna has a rigid configuration. Satellite weighs 270 lb.

the satellite's spin tolerance. In addition to the infrared receiver instruments there are other sensitive instruments being carried.

- **Satellite** will have its spin rate controlled by two weights located diametrically opposite on the sphere with web cables attached to the weights around the sphere in a direction opposite to the satellite's spin rate. These surrounding the weights will introduce a counter force to slow the satellite's rotation.

- **Planned orbit** is circular, at an altitude of 500 nautical miles with an inclination of just under 90 deg, but it's likely that some eccentricity will result.

- **Launch vehicle** will be the Able Star. This is scheduled to be the first time the Able Star vehicle—the ALV-104, a complex second-stage payload will have been flown. Similar to the more complex second-stage payload, the Able Star rocket engine, with about 7,500 lb thrust, represents a design refinement to previous first-stage by a factor of 2.2 for sustained burning. The engine also embodies shutdown and restart capability to meet the requirements for meeting Transit 1B into the planned 90-minute circular orbit. It is the first restartable engine scheduled to fly. This vehicle differs from the first Able Star used for earlier launch and space probes in that it has no fixed ship solid propellant rocket.

Preparation phases of the Able Star payload includes a guiding thrust chamber burning a hypergolic combination of nitroethane and nitrous oxide (NTO/N) and conventional chemical oxidizer (UDPH), and stacked negatively. Dual helium spheres provide the fuel volume.

- **Noise timing** on the Able Star will



- A. BOOSTER BURNOUT — T+2 MIN 44 SEC
- B. NOSE FAIRING JETTISONED — T+3 MIN 48 SEC
- C. SECOND STAGE FIRST CUTOFF — T+7 MIN 30 SEC
- D. COAST PHASE 30 MIN 25 SEC (RESTART)
- E. SECOND STAGE BURNOUT RESTARTED — T+28 MIN 40 SEC
- F. PAYLOAD SATELLITE IS INJECTED INTO ORBIT FOLLOWING
- G. SECOND STAGE SECOND CUTOFF — T+28 MIN 52 SEC

TRANSITABLE STAR launch vehicle will be first vehicle from Cape Canaveral, Fla., and then scheduled to orbit 44-day mission. Each program that will introduce a new along with the satellite. The satellite enters orbit at 11:00 a.m. on April 12.

Juno II Fails to Put Satellite in Orbit

Re Craig Lewis

Washington—June 11 Upper stage failure prevented a complex satellite mission from going into orbit last week to measure a local spectrum of solar-tsun on the Van Allen belts.

The extensive Explorer satellite was designed to fit a highly elliptical orbit and maintain a variety of radiation measurements as it passed through the Van Allen belts and through the space beyond them. Telemetry was lost shortly after burnout of the Japan's first stage. There was some indication of second stage ignition but apparently one of the solid propellant upper stages of the first stage failed. It is not clear.

National Aeronautics and Space Administration has other Janss II vehicles available if it decides to make another attempt to launch the radiation probe.

load used last week. The agency is scheduled to launch four other payloads this year to complete the Juso II series.

Satellite Instrumentation

Some time branched last work was about 38 in long and 7 in in diameter. It was attached to the case of the wind-down Sargent, which is the June 11 fourth stage. Surrounding the instrumentation cylinder was a box 12 in square and 9 in high, which carried solar cells on its interior. The 22.8 lb satellite included a 12.2 lb instrument pack, assembly, a 7.1 lb solar cell mechanism, a 2.5 lb instrument housing and 1 lb of satellite components. Attached rocket engine weighed 12.5 lb.

State University of Iowa Physics Department headed by Dr. James A. Van Allen returned the package of five rocks.

tion experiments in the athletes. Experiments were contained in a 6.3 l. pack, which was 9 in. high and 5.5 in. in diameter. It was designed as a plug-in package that could be installed and connected quickly to the power supply and transmitter in the instrument rack.

Satellite was launched on an injection of 28 deg from the equator. Its orbit was to have had a perigee of 208 mi., an apogee of 33,000 mi. and a period of 17 hr. This highly elliptical orbit would have given a broad swathe of radiation throughout the Van Allen belts and through space just beyond. It would have covered a span similar to the path flown by Explorer VI, but the jam-bunched payload would have taken a broader spectrum of measurements.

Radiation Detectors

To make flat spectrum of measurements, the article carried these flat detectors.

- **Detector A**, designed to count very low energy particles and thermal fast fissionable instrument capable of detecting electrons below 20,000 electron volts
 - **Detector B**, similar in design and designed to work in conjunction with Detector A to count electrons with energies between 20,000 and 200,000 electron volts
 - **Detector C**, a Geiger tube detector similar to those found earlier and designed to measure electrons in the 40,000 to 90,000 electron volt range
 - **Detector D**, using a Geiger tube design, designed to count electrons that it would measure only high energy particles far comparable with the Detector C counting rate
 - **Detector E**, a Geiger counter highly modified to provide data on moderate energy electrons
- Detector A occupied a hole of 60 centimeters outside inside a lead shield

with a hole in the end. Beffler shielded the hole from light but not from energetic particles. A magnetic field across the hole would bias all electrons with energies less than 200,000 electron volts in the detector would count all charged particles but electrons—primarily neutrons.

Detector B worked with Detector A. It was the same as Detector A, except there was no magnetic field across the shield hole to filter out electrons with energies below 220,000 electron volts. The difference between readings from Detectors A and B would provide a count of electrons in the 22,000- to 208,000-electron-volt range.

Detector C was a Geiger tube re-

Juno II Launch History

Date	Flight	Result
Dec. 6, 1956	Project III	Space probe missed at mean altitude 61,000 mi. altitude too low owing to earth. Returned within half day.
Mar. 5, 1959	Project IV	Space probe headed past the moon into orbit about the sun. Returned within days and was tracked to 407,000 mi. from earth.
July 16, 1959	Explorer radiation satellite	Detected 5 sec. of launch when guidance system surface traced.
Aug. 14, 1959	Isosceles radiation sphere	An density experiment failed to go into orbit when booster fuel ran out (no sun and upper stage attached) control system surface traced.
Oct. 15, 1959	Explorer VII	Report of July 30 launch past the moon into orbit and (1) a warning a variety of radiation data.
Mar. 23, 1960	Explorer radiation satellite	Complete radiation satellite failed to go into orbit when an upper stage apparently failed to fire.

Subject of the conference is recent research efforts on lifting man-made heavy-duty vehicles. Institutions were noted by Ed. Gen. Ramon C. Wilson, USAF deputy chief of staff for development, and Lt. H. Abbott, director of advanced research programs for National Aeronautics and Space Administration.

First two days of the meeting will cover generalized research, including aerodynamics, heat transfer, engines, that will be encountered, stability and control, piloting problems, instrumentation.

Second map does not deal specifically with Dyna-Son. Separate procurements will be made by NASA, USAF and Boeing Airplane Co., prime contractor for the manned vehicle portion of the Dyna-Son system. These will be divided into three main parts:

- Configuration studies
- Materials and structures
- Instrumentation, piloting, navigation and control systems

These basic questions are involved in the controversy over which type of stage should be developed.

Meeting to Deal With Dyna-Soar Dispute

Washington—Consumers at a
whether the DynaSoar vehicle should
be classified a nonaerobic shape or a
winged glider (AW Jan. 18, p. 31) by

not yet been settled. A four-day meeting of contractors and government officials has been called for Apr. 11-14 at Langley, Field, Va., partly to settle that question, which has delayed the shipment of Dyna-Son since shortly after prime contractors were selected four months ago (ENR Nov. 15, p. 29).

- Is the extra flexibility and safety offered by the winged homeguard in selection of landing sites and maneuverability at lower speeds worth the added complexity and weight of wings?

• Regardless of which shape it shows, is there any utility value to either?

ally important in determining the speed, money and effort that will be put into the Dyna-Soar program, and yet it is one that cannot be fully answered until a research vehicle has explored the flight regimes that Dyna-Soar is intended to evaluate.

A glider of the type that dominated Dornier's thinking through the past several years of study gains little or no advantage from its wings until it reaches speeds below about Mach 5.7. Since predictions over military targets would be made at hypersonic speeds, the basic Egger's capsule or a modification of it that carried very small winglike surfaces probably would have the same maneuverability.

Phase Alpha was initiated by Joseph Chini, then USAP assistant secretary for research and development, partly due to skepticism among some members of USA's Scientific Advisory Board and in the office of Herbert York, Defense Department director of research and engineering, over the global configuration.

Boeing was required to call in Bell, Lockheed, General Electric, Aero, McDonnell and Chance Vought to assist it with the Plant Alpha rescue. Work at the Martin Co., which was selected as the host for manufacturing, eventually has been stalled by the delay in decisions on the vehicle configuration.

Snap & Reactor Award

Wilmington—Aircraft General Corp. last week won a \$1 million National Aeronautics and Space Administration competition for electrical conversion equipment that will be used with the Space Shuttle (ENR Feb. 24 p. 26) for its auxiliary power system and for the first flight tests of an experimental ion engine—the first of the nuclear-electric engines that are expected to attain great importance for space vehicles.

An air-plasma jet propulsion system that will be used here with Stage 5, probably to boost a satellite from a 300 mi orbit to a 22,000 mi "stationary" orbit. Alouette International Division of North American Aviation, Inc., is building the 250 lb Stage 5, sending smaller Alouette Kites. *Stage 5 is complete.*

his engine to be used will be 1/20 to 1/10 of that. Two experimental engines have been operated at NASA's Lewis Research Center for a total of 70 hr. without failure.

NADA, on-board calls for cost recovery from users with a 90-day solubility (lifetime) to be delivered within 31 seconds or no more with 3 year solubility to be delivered within 5 years. All elements of the overall system including five different modules to expand system base into space, can be made in 31 to 5 years. NADA, however, The system could be tested on the Canstar vehicle.



COSEMIC RAY DETECTOR. package containing five collimator assemblies is positioned into cylindrical housing of Jumbo II collimator belt unit. Velocity transducer components are at bottom of package. Cylinder is surrounded by 1184 coils with.

Pioneer V Deep Space Reports Parallel Earlier Radiation Data

Washington—Pioneer V probe is returning deep space data from its recent six experiments which appear to support the radiation pattern predicted from earlier measurements made beyond the Van Allen belts.

Preliminary examination of data from the cosmic ray experiment indicates that measurements are within 2-3% of the readings made beyond the Van Allen belts by Explorer VI and that the similarity holds for out to the 1 million mi mark. Pioneer V passed the 2 million mi mark late last week and is scheduled to swing an orbital path that will carry it close to the orbit of Venus (AW Mar. 21, p. 28).

Explorer VI measured radiation below the Van Allen belts at altitudes up to 36,000 mi. Pioneer V is carrying some of these measurements beyond that area and will return data on the broad areas between the earth and Venus orbits. It is part of a growing effort by National Aeronautics and Space Administration to coordinate the investigations and mapping of radiation near the earth and out into space.

Possible Benefits

Discerning possible benefits from the Pioneer V radiation experiments, Dr. John Lindber, head of the solar plasma program in NASA's Space Sciences Division, points out that "radiation can be transmitted data on the speed of particles coming from the sun and then where whether particles in the Van Allen belt arrive as high energy particles or as low energy particles. The latter can be detected by some process in the earth's magnetic field. Measurements also can provide information on the origin and direction of cosmic radiation and can be

used to determine whether situations in solar background near the earth are similar to phenomena closer to the earth or whether this also occurs in deep space.

Pioneer V is still broadcasting with its five watt transmitter, but it has passed beyond the effective range of all ground stations but the 730 ft. Jodrell Bank radio telescope at Manchester, England. Each week month when the probe is 440-450 million mi. from earth and its radio waves are sent for the Jodrell Bank, the 118 watt transmitter will be switched on, and NASA hopes to continue to get data through the 118 watt unit until Pioneer V is about 50 million mi. from earth.

Probe's Signals

Originally, all the ground stations receiving the probe's signals were giving data in the range of 61 bits a second. As distance from the earth increases the bandwidth is reduced to permit signal to noise ratio. By the middle of last week, Manchester was down to eight bits a second, and the station at Hanau was receiving at the rate of one bit per second. Sixteen stations, equipped only with helical antennas, had the probe when it was about 300,000 mi. out.

Pioneer V's 15 watt solar power system is working well and recharging the probe's batteries at the expected rate. Pioneer system is substantially more powerful than past previous missions in Vanguard and Explorer VII, which is designed to operate at and survive between 500 and 1,300 ft., depending on altitude.

Budget still is studying a proposed constant fuelage version, the 942, which would carry 50 passengers in economy configuration.

Rodded-wheel Technique

Pioneer V and Explorer VI are smaller probes using the rod-wheeled technique to report data to the earth in a power supply. Changes were made in the Pioneer system, however, to guard against troubles encountered earlier by Explorer VI. Struts are structure was designed for the solar probes with rod-wheeled technique and Explorer VI probe was one solution that the Explorer VI probe was, were built during three stage springs and that one of the payloads failed to extend fully.

Failure of the probe to extend fully could have been caused by faulty operation of the cable which held the vanes down before extension. This cable was cut at a single point, but the Pioneer V probe was cut at four points to ensure extension.

Republic-Fokker Deal

Republic Aviation Corp. and Royal Netherlands Aircraft Factory (Fokker) will cooperate in production of aircraft and vehicles for the European market through operations completed at Amsterdam.

Under the deal, subject to approval by Fokker shareholders April 4, Republic will build about one-third of Fokker's total about \$1.5 million. Two Republic representatives will be appointed to the Fokker board of directors.

Republic will make available to Fokker as it knows in the field of VTOL aircraft, a program that has cost about \$400 million so far. Fokker will retain responsibility for Fokker F27 design. Republic will retain production, as well as production (complete) building the Lockheed F104G fighters. Republic 1150 aircraft manufacturing was first Fokker, and the Hawk model.

France Orders One Breguet 941 STOL

Paris—Breguet has received an order from the French government for construction of a single 941 short takeoff and landing prototype aircraft which is expected to be the first of the new generation of the 941 is 76 ft. length is 75 ft. The prototype will be powered by four Turbomeca Turmo 1 turbo props delivering 1,150 hp on takeoff to maximum maximum horsepower of 1,340.

Once weight of the 941 will be 30 tons, payload will be as much. The aircraft will cruise at 250 mph. It may be a replacement for the Explorer VII, which is designed to operate at and survive between 500 and 1,300 ft., depending on altitude.

Breguet still is studying a proposed constant fuelage version, the 942, which would carry 50 passengers in economy configuration.

Temco Sales, Earnings Declined in 1959

Temco Aircraft Corp. sales and net earnings declined in 1959, with sales being \$108,977,510 and net earnings being \$11,083,854 compared with 1958 sales of \$115,097,249 and a net of \$22,553,551.

Orders backlog as of Dec. 31, 1959, totaled \$65 million compared with \$100 million at the end of 1958.

Temco last week announced that it needed payment of a first quarter dividend noting funds are needed for weapons and space system development, capital improvements and new market opportunities.

Army Establishes Future Aviation Policy

By J. S. Bates, Jr.

Washington—Army aviation policy over the next few years has been firmly established under the following basis as a result of an intensive five-month review, issued by Chief of Staff Gen. Lemay December.

◆ **Design competition** for a new close support observation helicopter will be initiated in about 30 days to replace the Cessna L-19 light plane and the Bell H-147 and Sikorski H-123 helicopters now in service.

◆ **Development of a new transport helicopter** (new transport) of troops and equipment will not be an obstacle until further improvements have been made in the inherent state of the art. Progress directed toward the end probably will be undertaken in cooperation with one or more of the other services.

◆ **Excesses to develop a new high-speed surveillance** through a deep penetration behind enemy lines will not be made until further review of the fully used state of the art and operational requirements has been made.

Army has selected VTOL aircraft of a later form several agencies, some conducting engineering and operational evaluations indicating that this, which can provide the most effective aerial assault for troops and air. This is in line with a recent Air Force decision to postpone development of a high performance VTOL fighter for TAC for at least four to five years (AW Mar. 14, p. 28).

Many officials indicate that the decision to initiate deep support operations through a helicopter through a high speed VTOL, which was based largely upon five points:

- ◆ **Fast requirements** of the VTOL are considerably higher than that for a helicopter.
- ◆ **More stability and control** research work is needed before present types of VTOL aircraft will have acceptable performance in the operational controllability of the helicopter has been well proven.
- ◆ **Homework** security of the helicopter is much lower than that of the VTOL, and the effect of down in strong down and down during tactical operations is still unmeasured.
- ◆ **Helicopter** still has considerable development potential that can be exploited within a relatively short time.

Another parameter of vital concern to the performance of VTOL, acoustical power-to-weight ratio—was not held by the Army as a primary issue behind its choice of the helicopter. Army officials feel that engine performance in this area is now adequate for small VTOL aircraft, although improvements will be achieved in the future. The Army will continue to develop a new VTOL aircraft, but it will not be until the late 1960s or early 1970s that it will be ready to enter service.

◆ **Design competition** for a new close support observation helicopter will be initiated in about 30 days to replace the Cessna L-19 light plane and the Bell H-147 and Sikorski H-123 helicopters now in service.

◆ **Development of a new transport helicopter** (new transport) of troops and equipment will not be an obstacle until further improvements have been made in the inherent state of the art. Progress directed toward the end probably will be undertaken in cooperation with one or more of the other services.

◆ **Excesses to develop a new high-speed surveillance** through a deep penetration behind enemy lines will not be made until further review of the fully used state of the art and operational requirements has been made.

Army has selected VTOL aircraft of a later form several agencies, some conducting engineering and operational evaluations indicating that this, which can provide the most effective aerial assault for troops and air. This is in line with a recent Air Force decision to postpone development of a high performance VTOL fighter for TAC for at least four to five years (AW Mar. 14, p. 28).

Many officials indicate that the decision to initiate deep support operations through a helicopter through a high speed VTOL, which was based largely upon five points:

- ◆ **Fast requirements** of the VTOL are considerably higher than that for a helicopter.
- ◆ **More stability and control** research work is needed before present types of VTOL aircraft will have acceptable performance in the operational controllability of the helicopter has been well proven.
- ◆ **Homework** security of the helicopter is much lower than that of the VTOL, and the effect of down in strong down and down during tactical operations is still unmeasured.
- ◆ **Helicopter** still has considerable development potential that can be exploited within a relatively short time.

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Approaches to Controlled Fusion Detailed in Congressional Hearing

By Fred Ertman

Washington—Multiple attacks on plasma research projects may be underway before a successful method of fully achieving controlled thermonuclear reactions can be found, a Joint Congressional Subcommittee on Atomic Energy has told its staff.

Dr. Arthur E. Ruess, chief of controlled thermonuclear branch, with Atomic Energy Commission's Division of Research, told the subcommittee that, while solid achievements of the various approaches have been impressive, it is still not known which plan can give to be the most successful and ultimately lead to the development of an efficient fusion powerplant.

Major Research

Tokamak and major research is presently divided into the following programs aimed at overcoming the major problem of means of confining and stabilizing of plasma.

- **Stellarators**, "candle-burn" in the shape of hollow doughnuts or figure 8s, long used at Princeton University.
- **Magnetic mirror** approach, where particles of high energy are trapped inside magnetic bottles, used at Lawrence Radiation Laboratory and the Oak Ridge, Tenn., National Laboratory.
- **Self-confinement** methods, where strong currents are passed through the gas, which is confined by the magnetic field of these currents. These methods are practiced at Los Alamos Scientific Laboratory, Livermore, the University of California at Berkeley and the Naval Research Laboratory.

• **Alcator** programs, which currents of very hot plasmas are contained in conical and torus-like plasmas, used at Lawrence.

• **Spontaneous plasmas**, in which both electric and magnetic fields are employed. Several efforts in this program are carried out at Los Alamos Scientific Laboratory and the University of California at Berkeley.

Dr. Ruess and other leading U. S. physicists appeared before the Subcommittee on Research and Develop-

ment headed by Rep. Melvin Price (R-IL) in a report on progress being made in the various controlled thermonuclear reaction programs to date, all under AEC's Project Sherwood.

Witnesses said many "promising" advances have been made in the field and that thermonuclear temperatures probably will be realized as "billions of degrees of heat." Plasma temperatures of about 15 million F have been obtained, but temperatures in the area of 50 million F are required for thermonuclear ignition.

However, jet temperatures required to generate controlled thermonuclear power would be even higher, witnesses said and development of the first fusion powerplant probably will be from 10 to 15 years away.

Dr. Paul W. McDowell, acting director of AEC's Research Division, warned the committee that "it must not be supposed that our interests or those of our allies outside are likely to achieve anything quickly in the field of research, though some streaks of good fortune." Instead, he said it is a matter of gradually increasing capabilities.

McDowell told the committee the Soviet Union also had suggested a similar approach to controlled thermonuclear reaction problems but that the greatest present interest apparently is in the large magnetic mirror known as a CGR.

He said the Soviet has advised the U. S. scientists that they have completed a round of preliminary experiments in ion magnetic and that they plan to attempt the injection stage and current of the entering ion.

Despite the work in other parts of the world in this field, Dr. McDowell said he believed the U. S. continues to hold its position of leadership.

Two U. S. thermonuclear physicists—Dr. James L. Luck, of Los Alamos Scientific Laboratory, and Dr. Alan C. Kelly, of the Naval Research Laboratory, have expressed belief that they already have achieved thermonuclear reaction, although plasma temperatures reached were about one-fourth those needed for ignition.

Both men heated plasmas in a shock apparatus using a rapid rising magnetic field in a mirror geometry.

Dr. York and that recently, however, evidence has shifted to another high-energy injection into a pocket-like magnetic system. "The experiment," he said, "is now on the present operation and, which, proving to be a little more complicated than we envisioned in the beginning, is lacking

rather hoped . . . for the first time in all Sherwood, in this device I am least promising of a possibility of making a thermonuclear reaction."

In this method, York said, he injected jet of plasma from a previously developed plasma gun, is injected at the axial end of a pocket reactor. The jet is intended to drill through the magnetic field and fill the interior of the hollow torus and become confined and, therefore, contained in the focus.

York added that there is now an "urgent need for gas that will provide a good clean jet of plasma that should contain the energy to set in motion thermonuclear reactions, and we therefore are trying a substantial part of our effort into understanding the plasma gun we now have and developing new ones."

Cryogenic Cells

Dr. Richard F. Post, of the Lawrence Radiation Laboratory, told the committee that a promising step toward solving the long power needed to generate large volumes of intense magnetic fields appears possible through the use of cryogenic cells. These cells are not associated with the phenomenon of superconductivity, which cannot occur in the presence of a high magnetic field. They are instead made of either very high purity aluminum or high purity (indium metal) compressed in stainless steel tubes.

The theoretical advantages in the power required by the cell could amount to more than 1,000 Post said, so that, when the refrigeration power was added in, overall power of a factor of 20 or more were still predicted.

Companies Deciding Wind Tunnel Future

Passadena, Calif.—Decisions are expected around the middle of April on the future of the business enterprise wind tunnel here which is operated by California Institute of Technology for the five major aerospace companies who own the facility.

Due to the decline in the number of manned aircraft design which the tunnel was built to test at speeds up to Mach 1.5, three possibilities for the tunnel have been discussed.

• Complete closure of the tunnel, followed by dismantling during early next summer.

• Divorce, General Dynamics, Lockheed, McDonnell and North American, would take a job of the tunnel to Cal Tech and guarantee support for operation on a reduced scale to limited research work.

• Some company may take it over and operate it on a reduced scale.



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Minuteman Site

Minuteman AFB, Great Falls, Mont., was named last week to the support site for the initial operational deployment of the Minuteman intercontinental ICBM. Three Minuteman squadrons will be located in hardened sites in the Minuteman area.

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DEPENDS ON SO LITTLE...**

On turbines...in compressors...in hydraulic units — and in a host of other vital locations — the bearings must deliver at critical moments.

A high proportion of them are

A high proportion of them are solid cylindrical roller bearings . . . very simply because they do a better job over a longer period in less space.



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Washington—House Armed Services Committee, after seven months of study, has in effect left the solution of the problem of "influence peddling" to former military officers to self-police by Defense Department and the force of public opinion.

The investigating subcommittee headed by Rep. Edward Holtz (D-La.) launched its comprehensive investigation

Rep. Alfred Santangelo (D-N.Y.) first passed 1524-401, but was later defeated 159-146-0 on measures of the Herbert investigation (AW July 13, p. 37). And, when the mid-legislation vote by the Armed Services Committee scores to the floor for action during the week of Aug. 4, attempts will be made to make it more serious. House Rules Committee last week granted an "open rule" which will allow amend-

Two key actions taken by the Armed Services Committee are the following:

- Establish a "director of candorhood" in each of the military services. Define him, under the proposed legislation, would be required to submit a list of all former military officers (by company and their activities to the "director" for public record. All bids for contracts that would have to include such a list.

Objective of these provisions is to give a complete and public picture of the activities of foreign officials. Our constituents member and "At present, we do not know what we are shooting at. There is no complete record showing the extent of lobbying in the Pentagon. Now, we will have a record open for public inspection by the press and the public."

the possibilities, the needs and the requirements.

Defense Department is opposed to any type enrollment requirement for contractors—executive or public—and wants the enrollment of former officers with their former service considered an executive action. J. Vincent Burke, Jr., Defense general counsel, told the committee.

"The requirement that a contractor furnish a listing of actual officers who display each type he received in contract would undoubtedly result in many employers refusing to display actual military officers unless they are available."

The Armed Services Committee legislation also bans "sifting" by Defense Department by officers for two years after they leave their service. The results provided—loss of retirement pay for the time during the two-year period the officer is engaged in sifting—is not expected to be an effective deterrent to high-ranking officers, some of whom receive top positions with defense firms.

News

Controlling interest of about 68% of Britain's Eagle group of air transport companies is to be acquired, following an agreement in principle, by General Stewardship Co. Ltd. BOAC would technically remain as a subsidiary of General Steward and means in which the two major British airlines

Westinghouse Electric Corp. announced last week that it is withdrawing from the pit-gravel business and plans to refocus on the Navy's Kansas City, Mo., facilities that house the Navy's Advanced Gas Turbine Division. Westinghouse plans the Navy-owned Kansas City facilities with Bendix Corp., which occupies approximately one-third of the floor space, and with a regional office of the Internal Revenue Service. Bendix is considering expanding into at least a portion of the plant space now occupied by Westinghouse, but the Navy said last week that no final decision on that, too, was been made.

active service who have at no time served in procurement, maintenance or supply are exempted from the two-year provision. The committee and I did not think such officers could exert effective influence with their former service.

There already are statutes on the books providing for loss of retirement pay for "selling" to a foreign service: a two-year loss for Army and Air Corps and a lifetime ban for Navy and Marine Corps. In addition to making the previous law uniform, the armed services announced for the first time prohibits a former officer of one service from selling to another service, as well as to his own service.

Defense Department and the committee also are at odds as to what should constitute "jelling"—and be considered an important activity for former officers.

Defense Department wants a narrow definition that would include signing a bid, proposal, or contract; negotiating a contract; or contacting an officer or Defense Department official in connection with contract terms.

The committee in its report proposes an all-inclusive definition under which 'selling' would include any activity from the promotion of an idea to the display of a concept to the negotiation of contract terms for hardware.

A flap channel will be necessary and project is expected to take three to five years.

Bell Aircraft Corp. has an option for U.S. manufacturing rights to the supersonic ramjet-powered CT-41 and subsonic turbojet CT-30 target missiles developed by Nord Aviation of France.

Contract for construction of the glass fiber reference for the Marvel STON aircraft under development for the Army by Mississippi State College (AW Nov. 30, p. 96) has been let to the Perini's Corp., Aircraft Division, of Tuscarora City, Mich. Plans call for glass fiber, combing-changing wings and fuselage for the ducted propeller will be joined to a metal fuselage and flight deck at Mississippi River in Annapolis.

Air Force-Martin Titan was fired 5,800 m last week in its second full-range test. Data capsule was ejected from the postapogee Area Miss. IV operations were good, and the capsule was recovered near Ascension Island. This was the second Titan launch made without static testing the engines in Atlantic Missile Range and it indicates there will be no more flight readiness tests of this vehicle at AMR.

MATS Equipment Plan Gains Momentum

Growing support in Congress of fleet modernization programs may retard airline cargo expansion hopes.

By Robert H. Clark

Washington—Military Air Transport Service gained strong congressional support last week for an early start on a \$2 billion fleet modernization program in swift hearings which airlines fear may seriously retard industry plans for expansion of its cargo operations.

Industry hopes for a greater slice of MATS overseas cargo business apparently were crippled in the wake of military lethargy which stressed the obsolescence of aircraft carriers in both the MATS fleet and the Civil Reserve Air Fleet before sessions of the House Armed Services Subcommittee and the Senate Appropriations Subcommittee on the Armed Services.

Reported by American, Eastern, Pacific American and the Flying Tiger Line, the Monocacy toll is now a "dead zone," Monocacy said, so that providing the custom with adequate advice for cargo is a matter of the "highest priority."

Outcome of the first round of tests were before the two subcommittees in a prompt from Sen. A. S. Mink (D-Ore.) to the Senate Committee on Labor and Human Resources. Mink (D-Ore.), chairman of the House subcommittee, of senators support the MATS modernization program. "It is the only way to do it," he said, "to do it more cheaply than possible" to give MATS \$400 million for modernization rather than the \$16 million in the original 1961 program. The RABO bill would give the Navy \$600 million, which can be accomplished by modernizing the MATS fleet. The bill would also provide the Civil Aeronautics Board with \$100 million for the intermodal up to \$35 million for cargo aircraft, directed all government departments to shift more of national defense production to the private sector and required that aircraft selected for purchase with the least restrictions specifications of both the Department of Defense and the Federal Aviation

Engaged Mind?

Supporters of the Monetary legislation are now convinced that failure of the nations generally to support the bill would be advocated by Germany as a

Basic re-equipment needs of MATS, described by MATS commander Lt. Gen. William B. Tetter, include 18 "outsize" cargo planes, such as the Douglas C-130, 30 of which already

Local Legislation

At the same time, the industry also has lost what may have been its best lever on MATS business and the promise of future development of an air cargo transport straggle, to both the military and commercial carrier by failing to support Sen. Menendez's guaranteed loan legislation for the purchase of cargo aircraft (AWM Mar. 14, p. 25).

rubber "workhorses" were damaged within five years. The converted tankers, powered by Fiat & Whitney J41G rubber engines and capable of loading an average of 4,000 to 7,000 ft., could be delivered to MATS within 12-15 months if the funds are provided as the Fiscal 1961 budget, Gen. Turner insisted.

A total of 242 of the specially-designed "warehouse" aircraft will be needed to meet specific Air Force operational requirements calling for a turboprop or turboprop-powered aircraft with a speed of at least 440 kt and cargo/capacity capabilities of 48,000 lb at 9,000 feet or less and 20,000 lb at a range of 5,500 mi. Gen. Turner said.

Delivery Time

Boring Airplane Co. supported Transair's estimates of delivery time on the KC-115 "fast sequence" jointly with a 60,000,000 to prebid and estimated that conversion costs would not exceed \$1.5 million per airplane. Specifications that MATS' orders might interfere with Strategic Air Command orders for the tankers also was discounted by the company, which said it is now producing aircraft at the rate of seven per month and could easily double its production rate to accommodate both the SAC and MATS orders.

The manufacturer also has offered MAHS an interim cargo version of the Boeing 787, a 715-seater powered by turbofan engines, as an off-the-shelf item. The aircraft would have a cargo capacity of 100,000 lb and could be designed in either a wingtip, run or side-loading configuration. A more recent Boeing proposal would include a modified freight loading device.

MATS instructors also has succeeded in teaching off a layer of new, proposed for both interim and workman air cuts.

Secret - When Filed

Lockheed Aircraft Co. has presented plans for a swept wing, turboprop version of the larger Hercules designated as the GL 707-42 designed to meet MATS specific operational requirements. Essentially, the new design is a 280 in. stretch of the C-130B cargo transport with fuselage stretched length increasing. Estimated price for the Lockheed transport was set at \$4.9 million if it was ordered in quantity.

Concor Distance of Control Dynamics Corp. also is prepared to submit a basically new design for MATS and

horse designated the Comstar 105. The swept wing aircraft is about the size of the Model 500 transport and would be powered by four Pratt & Whitney or General Electric turbofan engines. It would include low bid loading and would exceed the specific operational requirements set forth by the military, the company said.

Douglas Aircraft Co. previously submitted designs for a cargo version of the DC-8 in a meeting last November with JTS powerplants and recently offered MATS a normal variant with a stretched fuselage powered by Pratt & Whitney JT7 turbofans. The later design also incorporated a complete cargo handling system involving computers and conveyors. Delivery time on the first model was estimated by the manufacturer at between 18 and 24 months.

Designers Disputed

While final selection of the MATS aircraft may later be influenced by testimony from government agencies and airlines, Gov. Farnes and Sen. Monroney both succeeded in virtually lifting the national ban.

Contracting MATS present high operational and cargo transport is continuing a "lot of bad business" so that "no commercial operator is in his right mind" could afford to operate there. Sen. Monroney later told Aviation Week he doesn't agree with Tamm's suggestion of ordering KC-135 cargo conversions because they would be too costly for a five-year-old plane.

same opinion, says the White House, Department of Commerce and Defense Department have developed out the need for more MIA traffic to be handled by the industry.

Federal Aviation Agency and the Civil Aeronautics Board, and the surface industry are scheduled to appear before the Senate and House subcommittees in the MATS public hearings while the Air Force is expected to submit a report to the Department of Defense recommendations to implement the MATS program approved by President Eisenhower (AW Feb. 11, p. 36).

The cover tale uses with MATS' contention that it needs a fleet of 75 medium assault transporters to meet its training needs for its "hardcore" operations it might be cited upon as inadequate in support of an initial Stop-Armed-Commander wartime mission. Contending that MATS is ignoring both White House and Defense Department directives that it can build a commercial type, shift, the salient is that, while MATS has definite responsibilities requiring extensive training equipment, it is attempting to justify its total cost first needs by using the all of the light equipment it needs for emergency missions.

David M. Meyer

Recent staging of the MARS unit of 21,000 troops in Puerto Rico as the Grand Slam experiment was considered

by every subject as an educational presentation designed to demonstrate MAT logistics problems and thus give congressional support for modern flight computers!

Results of the test drew mixed reactions. Lt. Gen. Mark E. Stoffer, Jr., USAF deputy chief of staff, officers told the Senate subcommittee that the experiment was "very successful" and a "very fine tribute" to NATO. Sen. Stuart Symington (D-Mo.) termed the exercise a "definite demonstration of the great defenses of which we will be required to fight the type of war which is highly more probable than the probability of a nuclear confrontation."

MATS maintains an inventory of current methods of wrapping materials in the low bidder also has drawn the line of the surface, which point out that it too often results in heavy financial losses and variability among bidders that are tempted to enter bids too low to cover their expenses. The second Department of Commerce transportation study (AW Mar 23, p. 42) also calls for a change in material handling practices on public projects, then, must not.

Sen. Menendez backs the reform aimed at easing Rep. Rosten. Menendez views the MATS bidding process as "one of ongoing headaches" at what

the military spends but amounts to a legion of carriers, many of which own an aircraft but use leased transports. It is pressing for an agreement which will permit the award of contracts on a common carriage rate basis set by the Civil Aeronautics Board.

Such a policy was proposed to USAF several months ago by Northwest, Pan American, TWA and Southern & Western Airlines and is understood to be meeting a final round of the Kissinger Commission, now studying changes in MATS policy for the Air Force. The committee was asked to advise on the best methods of implementing the policy guidelines approved by the President in the recent report, "The Role of MATS in Peace and War."

Continued Reading

Rep. Rosten also supports Monroney's views on contract bidding and adds that he favors passage of a bill that would force contracts lasting five years to permit the bidder to amortize the cost of new cargo transport.

National Airlines made a move in this direction last week when it offered to purchase five Lockheed C-130H transports at a cost of \$44 million if the Air Material Command awarded it a cost-to-cost logging contract for a period of one year with a guaranteed fee you started. The airline noted that it had worked out the details with Lockheed officials and under the offer it wanted to the government's need for expanded military or cargo service.

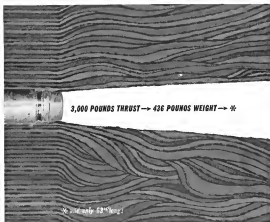
In latest action affecting contract awards to the airlines, Sen. Voinovich (D-Ind.) has introduced a bill that would permit the awarding of MATS contracts only to certified air carriers included in the Table of Airway Air and regulated by the Civil Aeronautics Board. The CAB supported bill is aimed primarily at Part II operators subject only to FAA safety performance requirements. Board members confessed that few firms of those carriers from regulatory powers under which would award contracts until specific prices there is a divided regulatory advantage flow as there is not lower rates.

Mohawk Suspends Service Over Strike

Uses, N.Y.—Molokai Airlines' operations were still shut down last week following a brief strike by its 67 stewards. The airline's management suspended all service Mar. 18 after pilots refused to cross the stewardess picket lines.

As of last Wednesday, Mohawk's management was holding to its position that no negotiations or mediation meetings would be held until an agreement was agreed.

10



New Pratt & Whitney Aircraft JT12 jet engine is built around proven design concepts for high thrust to weight ratio, regardless, reliability and low maintenance.

The JT12 achieves horsepower thrust in comparison to the light weight of the engine itself. At maximum cruising speed the thrust specific fuel consumption is only .546. A low jet engine designed on a proven principle, the JT12 is an axial-flow, medium-pressure-ratio turbojet. Behind the JT12 stands all the research, manufacturing and testing facilities that produced the renowned Pratt & Whitney Aircraft 2-57 and 3-75 designs—the new standards of aircraft engine reliability in commercial jet transportation. Because of the sound basic design of the JT12 and its relatively simple construction, it's an outstandingly reliable and easily maintained engine. The JT12 now powers such aircraft as the Lockheed JetStar transport, the North American Sabreliner and the Cessna 441 military trainer, and two U. S. Army drones. Today, the JT12 is establishing new flight performance records of its own.



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Dallas-Ft. Worth Airline Pilots Criticize Love Field Facilities

Dallas, Tex.—Members of *Airline Pilot's Assn.*, currently operating in the Dallas-Ft. Worth area, last week supported a letter signed by 500 ALPA pilots residing in the Dallas-Ft. Worth area who strongly criticized approach and landing facilities at Love Field.

Most thought of attack in the letter was lack of a "configuration A" critical approach lighting system (see p. 108) on Love Fields 7, 9 and 10, instrument runway. Plans termed as "add-on" for the last two fields at Love Field are still operating with the south-southwest low approach lights 2,700 ft. in length, and term as "foxtails" that they have as an alternative alternative Annex Center field, midway between Dallas and Ft. Worth.

According to airline pilots Dallas aviation officials responding to queries about the letter have been unimpressed that it did not represent a majority opinion of ALPA membership in this area.

In addition, members of council representing airlines operating in this area quickly approved resolution asking that new approach lighting be installed on the letter was backed by rank and file opinion.

A survey of pilots in the area also indicated that they plan to keep the issue alive. The letter also was sent to FAA Administrator Edward P. Duane, Sen. A. S. (Mike) Mansfield and L. C. Elbert, FAA regional administrator, ALPA President C. N. Boyce and other parties.

Safety Improvement

The airline pilot letter notes that they do not consider Love Field as safe, but that operational safety could be greatly improved. It says that the approach pilots, more of Love Field's traffic, simply proceed to an alternate field, usually Annex Center, when using and reliability conditions go below the minimum, allowed by the "authorized approach light facilities."

American Airlines has a 504-ft. and three-quarter mile company instrument for the Boeing 707 jet transport an instrument approach in Annex Center, a 50-ft. and approach instrument the Love Field Annex Center's instrument runway, contains a standard centerline high intensity system with red-green lights and point markings for runway visual range penetrating landings with 1,600 ft. forward visibility, with no requirement on cloud height above the ground.

So far, since the start of the 707 service into Dallas last summer, approximately 4,000 landings have been made into Annex Center instead of the original destination, Love Field, in addition to seasonal diversions to El Paso or Tulsa, Okla., when Love and/or Annex Center air fields were considered below minimum.

Another area criticism of pilots is that there have been no successful in establishing a pattern of determining what they call "critical problems" in airport operations and future planning, pointing out that they have not been approached or asked what they consider adequate solutions to the problem.

Another criticism spread apparently last that these problems are properly handled only with airline expert engineers and qualified Federal Aviation Agency personnel.

Airport Relieves

Pilots note that they enjoy considerable safe facilities within the safety of Annex Center field and quote a letter written there in 1951 which asked airline directly was true, then, use anything on that field which they felt could stand correction to improve safety conditions. The letter pointed out that pilots "no better qualified than anyone else that I know to keep us advised on what should be done to make our landings and take-offs better and safer."

Dallas aviation officials noted that they will ask the FAA to approve a plan for a so-called "short system" of centerline lighting, which can cover the current 2,700-ft. left and approach lights. They would add some 500 ft. short of a standard "configuration A," but Dallas officials point out that the standard configuration would require equipment some facilities in line with the current lighting system now on that they are reluctant to incur the right of consent decision to test the property owner until all means of making the problem have been considered.

Information that this objection would for such a non-standard system would be done, the airport has been turned down previously on such a plan. Also, pilots have opposed any diversion from the standard concept.

Shorter Runway

Pilots also are critical of the fact that Love Field's instrument runway is some 1,600 ft. shorter than Annex Center's and point out that a new parallel runway, approximately 3,900 ft. long, planned for construction at Love Field will mean, also, the short of the standard minimum length. "We beg of you,

however in being the existing instrument runway up to minimum national standards, before building another runway that will also not meet the requirements for all modern facilities," the pilots' letter states.

Not Critical Factor

In rebuttal, Dallas officials stated that requirements sufficient that the length of the instrument runway has not been a critical factor on the comparatively shorted Dallas-New York, Dallas-Chicago and Dallas-Los Angeles and San Francisco air services because the airplanes are operating consistently below takeoff weights required for the longer New York-West Coast and transatlantic flights. They also feel that takeoff and instrument runway requirements for aircraft for American's fleet of 707s and advent of the lighter Boeing 712, will make runway extension unnecessary.

That this does not match up with FAA thinking is indicated in that agency's recent refusal to approve a \$1.8 million grant to Love Field for construction of the parallel runway. However, the agency did state the agency felt that an length did not meet its requirements on the obstacle indicated need for this location. Local Dallas supporters claim that they will of accuracy passed with building the new runway with money raised by private groups supported actively by airport income.

TAI Will Lease DC-8s For New Pacific Routes

Paris—TAI, possibly owned French airline, will lease the Douglas DC-8 four-engine transport from another private French carrier, UAT, to begin jet service between Paris and New Guinea in July.

TAI is receiving the first of three DC-8s on order in June with the balance scheduled for delivery in May, 1961. However, TAI is entering the UAT DC-8s so that it can begin service on its new routes to New Guinea from New Guinea to New Guinea from Paris (AW Mar. 7, p. 344) as soon as possible.

The jet service will be extended to Tahiti, Honolulu and Los Angeles from New Guinea where the TAI transport is completed, probably sometime this fall.

In the meantime, DC-8s will serve the New Guinea-Los Angeles segment of the route.

UAT previously has decided the DC-8s does not fit its French African route pattern but, beyond the TAI route agreement, it has made no announcement to the disposition of the two aircraft.

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traditional jelling
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^aNot completed

FROM WEEK, from Address, Eng

the Civil Airplane Board.

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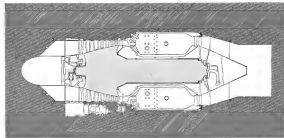
	Revenue Passengers	Revenue Passenger Miles (RPM)	Load Factor %	U. S. Mail Ton-Miles	Express Ton-Miles	Freight Ton-Miles	Total Revenue Ton-Miles	% Revenue in Aircraft Ton-Miles
SCOUTLINE LINES								
American	820,135	301,497	87.0	1,331,250	199,000	8,330,860	10,661,110	62.9
Boeing	170,823	81,268	88.0	321,420	171,473	448,598	938,491	40.9
Continental	278,454	114,194	87.0	1,200,000	220,418	1,000,000	2,420,418	62.9
Convair	111,731	26,308	82.0	173,110	120,304	738,614	1,031,928	40.9
Delta	347,370	154,840	89.0	807,471	227,492	1,734,840	3,769,793	62.9
Eastern	499,484	200,127	90.0	1,100,000	212,000	1,400,000	2,712,000	62.9
National	145,913	103,336	91.0	323,812	77,320	375,500	877,132	62.9
Northeast	100,730	38,490	91.0	120,000	18,000	120,000	258,000	62.9
Norwest	100,730	181,200	91.0	1,100,000	212,000	1,400,000	2,712,000	62.9
Trans World	400,730	240,000	82.0	1,400,000	212,000	2,400,000	4,012,000	62.9
United	120,730	33,187	86.0	1,400,000	212,000	1,400,000	2,712,000	62.9
Western	150,440	67,381	82.0	300,000	100,000	1,000,000	1,400,000	62.9
INTERNATIONAL								
American	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Boeing	5,000	7,000	82.0	3,000	100	100,000	1,210,000	62.9
Continental	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Delta	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Eastern	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
National	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Northeast	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Norwest	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Trans World	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
United	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Western	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
LOCAL SERVICE								
Allegiance	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Boeing	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Continental	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Delta	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Eastern	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
National	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Northeast	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Norwest	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Trans World	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
United	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Western	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
RAVENS								
American	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Boeing	10,000	10,000	88.0	8,000	200	100,000	1,210,000	62.9
Continental								

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Orpheus turbojet—already flying in 6 different aircraft—now reaches 6,810 lb thrust dry, over 6:1 thrust/weight ratio . . .



...ANOTHER ENGINEERING ADVANCE BY BRISTOL SIDDELEY



ORPHEUS 800—ground arrangement showing the low bearing friction.

The design philosophy behind the Orpheus family of engines was based on two engineering requirements—extremely light weight and exceptional reliability. That these requirements were successfully reconciled is shown by the fact that the Orpheus has been specified in five countries for no fewer than 14 distinct types of aircraft, six of which are already flying. The Orpheus is undoubtedly the most advanced medium-thrust turbojet engine in the world and the latest version, the B Or 12, has more than twice the thrust of the original Orpheus which first flew in 1955.

The Bristol Siddeley Orpheus B Or 12, like the earlier versions, achieves its outstanding performance through basic simplicity of design. Producing 6,810-lb thrust dry (8,170-lb thrust with augmented exhaust), for a weight of 1,100 lb, the B Or 12 has a very high thrust/weight ratio of over 6:1. This is combined with a good specific fuel consumption (5032 lb/lb/hr at maximum continuous rpm, sea-level static conditions), very

compact dimensions (51.4 in from intake flange to exhaust flange, 32.4 in diameter), and minimum servicing requirements.

Omnipresent Orpheus. The Orpheus family has a far wider range of applications than any other two-engine in its class. The design has been proved by a remarkable record of trouble-free operation and versatile Orpheus versions power aircraft ranging from trainers and executive transports to modern aircraft and lightweight strike fighters. The last category includes the Fiat G-91, NATO's standard strike fighter, powered by the Orpheus 800 (shown above).

The Orpheus is in production in India and Italy as well as Great Britain, and will shortly be built in Germany. For further information, please write to—*Bristol Aero-Industries Limited, 280 International Aviation Building, Montreal 4, Canada, Telephone, University 6-3671.*



BRISTOL SIDDELEY ENGINES LIMITED

LAKE CENTRAL AIRLINES orders

5 ALLISON

Prop-Jet SUPER CONVAIRS



to bring its passengers the fastest scheduled local service in America

Lake Central Airlines starts its second decade of service in the Great Lakes-Ohio River Valley area by taking a giant step into the jet age—ordering five Allison Prop-Jet Super Conquairs for delivery starting in late summer.

Lake Central's Board of Directors has also taken an option on 10 additional Prop-Jet Super Conquairs from General Motors Allison Division — which promises continued improvement in passenger service for years to come. Allison Prop-Jet Super Conquairs are standard 340/440 aircraft modified to use Allison 501 Prop-Jet Engines and AeroProducts Turbo-Propellers. In addition to conversion from piston engine to Prop-Jet power, the

modification program includes new nacelles and other airframe changes, which bring the aircraft up to thoroughly modern jet-age standards. The conversion work is performed for Allison by PacAero Engineering Corp., a subsidiary of Pacific Aerospace Corp., Santa Monica, Calif.

When these 350-passenger airlines enter service, Lake Central will offer its passengers the fastest scheduled local airline service in America.

The line's passengers will travel in planes far quieter, more vibration-free and more comfortable than any piston-powered airlines serving any other local carrier.

And they'll ride in fully pressurized, completely air-conditioned 50-passenger aircraft that will get them to their local destinations far sooner, far more rested and relaxed than ever before.

As airline is so good as its service to passengers — and Lake Central is making certain its service is the best.



ALLISON PROP-JET POWER



Passengers Enplaned in Latin America By U. S. Flag Carriers in 1959

	America	South	Caribbean	Asia	Europe	Mexico	South	Passenger	Passenger	Women	Total	Rank
American Airlines	4,310							4,310	1,308	2,998	21	
American Overseas	150							150	700	47		
American Pacific	17							17	19	46		
American Airlines	149							149	100	21		
American Overseas	1,341							1,341	301	1,040	24	
Eastern	7,707							7,707	10,726	10,726	4	
Eastern Overseas	1,000							1,000	1,000	1,000	5	
Eastern Overseas	1,000							1,000	1,000	1,000	6	
Eastern Overseas	1,000							1,000	1,000	1,000	7	
Eastern Overseas	1,000							1,000	1,000	1,000	8	
Eastern Overseas	1,000							1,000	1,000	1,000	9	
Eastern Overseas	1,000							1,000	1,000	1,000	10	
Eastern Overseas	1,000							1,000	1,000	1,000	11	
Eastern Overseas	1,000							1,000	1,000	1,000	12	
Eastern Overseas	1,000							1,000	1,000	1,000	13	
Eastern Overseas	1,000							1,000	1,000	1,000	14	
Eastern Overseas	1,000							1,000	1,000	1,000	15	
Eastern Overseas	1,000							1,000	1,000	1,000	16	
Eastern Overseas	1,000							1,000	1,000	1,000	17	
Eastern Overseas	1,000							1,000	1,000	1,000	18	
Eastern Overseas	1,000							1,000	1,000	1,000	19	
Eastern Overseas	1,000							1,000	1,000	1,000	20	
Eastern Overseas	1,000							1,000	1,000	1,000	21	
Eastern Overseas	1,000							1,000	1,000	1,000	22	
Eastern Overseas	1,000							1,000	1,000	1,000	23	
Eastern Overseas	1,000							1,000	1,000	1,000	24	
Eastern Overseas	1,000							1,000	1,000	1,000	25	
Eastern Overseas	1,000							1,000	1,000	1,000	26	
Eastern Overseas	1,000							1,000	1,000	1,000	27	
Eastern Overseas	1,000							1,000	1,000	1,000	28	
Eastern Overseas	1,000							1,000	1,000	1,000	29	
Eastern Overseas	1,000							1,000	1,000	1,000	30	
Eastern Overseas	1,000							1,000	1,000	1,000	31	
Eastern Overseas	1,000							1,000	1,000	1,000	32	
Eastern Overseas	1,000							1,000	1,000	1,000	33	
Eastern Overseas	1,000							1,000	1,000	1,000	34	
Eastern Overseas	1,000							1,000	1,000	1,000	35	
Eastern Overseas	1,000							1,000	1,000	1,000	36	
Eastern Overseas	1,000							1,000	1,000	1,000	37	
Eastern Overseas	1,000							1,000	1,000	1,000	38	
Eastern Overseas	1,000							1,000	1,000	1,000	39	
Eastern Overseas	1,000							1,000	1,000	1,000	40	
Eastern Overseas	1,000							1,000	1,000	1,000	41	
Eastern Overseas	1,000							1,000	1,000	1,000	42	
Eastern Overseas	1,000							1,000	1,000	1,000	43	
Eastern Overseas	1,000							1,000	1,000	1,000	44	
Eastern Overseas	1,000							1,000	1,000	1,000	45	
Eastern Overseas	1,000							1,000	1,000	1,000	46	
Eastern Overseas	1,000							1,000	1,000	1,000	47	
Eastern Overseas	1,000							1,000	1,000	1,000	48	
Eastern Overseas	1,000							1,000	1,000	1,000	49	
Eastern Overseas	1,000							1,000	1,000	1,000	50	
Eastern Overseas	1,000							1,000	1,000	1,000	51	
Eastern Overseas	1,000							1,000	1,000	1,000	52	
Eastern Overseas	1,000							1,000	1,000	1,000	53	
Eastern Overseas	1,000							1,000	1,000	1,000	54	
Eastern Overseas	1,000							1,000	1,000	1,000	55	
Eastern Overseas	1,000							1,000	1,000	1,000	56	
Eastern Overseas	1,000							1,000	1,000	1,000	57	
Eastern Overseas	1,000							1,000	1,000	1,000	58	
Eastern Overseas	1,000							1,000	1,000	1,000	59	
Eastern Overseas	1,000							1,000	1,000	1,000	60	
Eastern Overseas	1,000							1,000	1,000	1,000	61	
Eastern Overseas	1,000							1,000	1,000	1,000	62	
Eastern Overseas	1,000							1,000	1,000	1,000	63	
Eastern Overseas	1,000							1,000	1,000	1,000	64	
Eastern Overseas	1,000							1,000	1,000	1,000	65	
Eastern Overseas	1,000							1,000	1,000	1,000	66	
Eastern Overseas	1,000							1,000	1,000	1,000	67	
Eastern Overseas	1,000							1,000	1,000	1,000	68	
Eastern Overseas	1,000							1,000	1,000	1,000	69	
Eastern Overseas	1,000							1,000	1,000	1,000	70	
Eastern Overseas	1,000							1,000	1,000	1,000	71	
Eastern Overseas	1,000							1,000	1,000	1,000	72	
Eastern Overseas	1,000							1,000	1,000	1,000	73	
Eastern Overseas	1,000							1,000	1,000	1,000	74	
Eastern Overseas	1,000							1,000	1,000	1,000	75	
Eastern Overseas	1,000							1,000	1,000	1,000	76	
Eastern Overseas	1,000							1,000	1,000	1,000	77	
Eastern Overseas	1,000							1,000	1,000	1,000	78	
Eastern Overseas	1,000							1,000	1,000	1,000	79	
Eastern Overseas	1,000							1,000	1,000	1,000	80	
Eastern Overseas	1,000							1,000	1,000	1,000	81	
Eastern Overseas	1,000							1,000	1,000	1,000	82	
Eastern Overseas	1,000							1,000	1,000	1,000	83	
Eastern Overseas	1,000							1,000	1,000	1,000	84	
Eastern Overseas	1,000							1,000	1,000	1,000	85	
Eastern Overseas	1,000							1,000	1,000	1,000	86	
Eastern Overseas	1,000							1,000	1,000	1,000	87	
Eastern Overseas	1,000							1,000	1,000	1,000	88	
Eastern Overseas	1,000							1,000	1,000	1,000	89	
Eastern Overseas	1,000							1,000	1,000	1,000	90	
Eastern Overseas	1,000							1,000	1,000	1,000	91	
Eastern Overseas	1,000							1,000	1,000	1,000	92	
Eastern Overseas	1,000							1,000	1,000	1,000	93	
Eastern Overseas	1,000							1,000	1,000	1,000	94	
Eastern Overseas	1,000							1,000	1,000	1,000	95	
Eastern Overseas	1,000							1,000	1,000	1,000	96	
Eastern Overseas	1,000							1,000	1,000	1,000	97	
Eastern Overseas	1,000							1,000	1,000	1,000	98	
Eastern Overseas	1,000							1,000	1,000	1,000	99	
Eastern Overseas	1,000							1,000	1,000	1,000	100	

Source: Civil Aeronautics Board, Office of Air Transportation Statistics

AIRLINE OBSERVER

► **American Airlines** has abandoned hopes for short field modifications on its current generation Cessna 600 jet transports, first of which is scheduled for delivery early next year. The airline, which expects the 600 to meet more than most performance requirements, had sought further improvements through such possible design as boundary layer control (BLC [see p. 41]). The jet probably would operate out of such airports as La Guardia Field and Anacostia had had hoped for a greater margin in stallage speed and short field airport characteristics. However, the modifications appear impossible at this stage of development of the airplane, which is expected to fly this spring.

► **Proposed plan to place air traffic controllers under a number of military-type regulations** is making no headway. Federal Aviation Agency will submit congressional suggestions to adjust a proposed plan to Congress by Jan. 1 but was unable to meet the deadline and requested a postponement which was granted. Purpose of the proposal was to prevent direct interaction of civil and military air traffic control activities and to ensure a strong and experienced cadre of controllers in the event of a national emergency. Original plan, which for example, would subject controllers to various management and support air standards action plans to improve, has been watered down substantially but still faces a number of legal hurdles. Even the constitutionality of the plan has been challenged.

► **Tirelines available** seat sales declined from 4.64 billion in January to 3.73 billion in February. However, the February total represented a 14.4% increase over the 3.31 billion available seat sales generated by the airlines during February of 1990.

► **Aeroflot** has finally begun nonstop proving flights between Moscow and Kharkov, with four turbojets Tu-154s. Boeing's 747-300, which was originally slated to go into scheduled service last fall, is now scheduled for regular non-Siberian service this spring.

► **Pilot's role in defense experience jet transports** may become that of a supervisor or monitor rather than a direct controller of vehicle's flight path and powerplant, with greatly increased use of avionics to perform routine functions automatically. FAA Administrator E. R. Quastel told a recent meeting of the Electronic Industries Assn. Although such automation will come in stages, the entire flight from takeoff to landing may ultimately be controlled automatically, Quastel predicted. This will challenge the industry to provide extremely reliable avionics equipment, he added.

► **Airline** bench has increased total 16 in January, according to Joe John, Marshall Bailey (R-N.H.). Between September 1987, and December 1989, reported bench figures dropped 10% and amounted to 102. Sen. Bailey has introduced legislation calling for a penalty against convicted bench busters of a \$1,000 fine or five years in jail or both. Present penalty is \$1,000 or one year in jail or both.

► **Export-import Bank of Washington** will finance the sale of four Douglas DC-8-40 jet transports to Africa. The seven-and-a-half-year loan of \$117 million will be disbursed to British Midland Airlines for use by Africa to buy the airplanes which will be powered by Rolls-Royce Conway turbo engines.

► **International Air Transport Assn.** proposed resolution that no member airline shall honor credit cards for the sale of transportation other than a United Air Travel Pass and no member airline shall honor a check issued by the Civil Aeronautics Board on grounds that the resolution violates contract laws. In proposing the resolution, supporting carriers argued that the additional cost of outside credit cards would be substantial, would not generate new traffic and would call for an increase in working capital and in the cost of financing airline operations. Board found that the resolution "seems to be part of a contract plan."

► **Midwest East Airlines** has purchased a firm of four de Havilland Comet 4C aircraft powered with Rolls-Royce Avon turbojet engines for delivery beginning late this year.

SHORTLINES

► **Flying Tiger Line** has received all cargo contracts from the Military Air Transport Service totaling \$1,081,000 to fly 31 transoceanic and transpacific flights during March and April.

► **KLM Royal Dutch Airlines** is scheduled to begin transatlantic Douglas DC-8-40 turbojet transport service on Apr. 18, with one flight a week. On Apr. 17, the airline will start flying three weekly nonstop round trips from New York to Amsterdam and, on May 15, will increase the DC-8 service to a daily basis. By the end of the summer, KLM hopes to have 14 nonstop trips per week on the Atlantic route. On Jan. 13, the Dutch carrier will place DC-8s on its Amsterdam-Moscow-Berlin route on a two round trips per week basis.

► **Lufthansa German Airlines** has been awarded an amended foreign air carrier permit by the Civil Aeronautics Board to serve San Francisco in addition to New York and Chicago. Flights originating in Germany, and stopping at several European cities will fly the Airbus, stop in these Canadian points and terminate in San Francisco.

► **National Airlines** was scheduled to resume daily Douglas DC-8-40 nonstop flights from New York to Havana but having a two-month setback, because of a drop in ticket sales leading to go to Cuba. The carrier has been operating a reduced weekend schedule.

► **Pan American World Airways** will be beginning the new Bermuda capital of Bermuda on Apr. 3 as a two flights per week basis. Bermuda will be included on Pan Am's New York, Caracas, San Juan, Jamaica, San Pedro, Montserrat, San Juan route. Initially, the airline will operate with Douglas DC-8-40 aircraft, adding turbojet equipment as soon as airport improvements can be made at Rio de Janeiro. Pan Am's new beginning June 1, will add London, Barcelona and Nice to its route from New York to Rome using turbojet equipment. There will be two flights per week, with June 15, when the frequency is scheduled to be accelerated to three flights a week.

► **Southern Airways'** temporary mail rates for the period July 1 have been established by Civil Aeronautics Board through Nov. 30 at \$1,340,000. For each calendar month after Dec. 1, 1991, the Board ordered that Southern be paid at a rate of \$6.10 cents to be applied to the scheduled revenue under flown during the month, or \$5,500 in times the number of days in the month, whichever is lower.

General Motors

Blocks Heat For Lockheed!



Harrison Aircraft Oil Cooler and Radiator, Product of General Motors, Detroit.

VERSATILE NEW JET-POWERED ELECTRA SPECIFIES HARRISON FOR CRUCIAL OIL COOLING!

Harrison handles the heat on Lockheed's Electra! Boring smoothly upward to 25,000 feet . . . arriving at over 100 m.p.h. . . this popular airliner relies on Harrison heat exchangers to maintain safe, efficient oil temperatures on its four Allison prop-jet engines. Guarding vital operating temperatures on today's advanced aircraft is a Harrison specialty. Harrison's long experience and research in the heat-transfer field assure complete reliability . . . peak temperature-control efficiency under the most severe operating conditions. If you have a cooling problem . . . look to the leader. Look to Harrison for the answer!

GM PRODUCT RELIABILITY . . . THE KEY TO GREATER VALUE!



AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION OF GENERAL MOTORS, LOCKPORT, NEW YORK

Atlas-Agena Vehicle Fails to Orbit Midas



First test firing of Midas satellite shows fasted Agena stage mated to Carrier Atlas for full test.

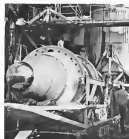


Even Midas, which only waiting satellite launch into test, shortly was under control. Agena stage has served as Thor's first satellite since Douglas Thor and will be used on both Thor and Atlas in space missions. Spacecraft's own recovery vehicle system also uses Atlas plus Agena. Agena, powered by Bell Rocket engines, is well-suited to operational use. Prototype of Midas later test detection system have been flown as usually to test their ability to detect and monitor trajectory of test missile launches (AFR Feb. 8, p. 21). Recovery of Midas can be placed in Vandenberg AFB, Calif.

SPACE TECHNOLOGY



Midair of first attempt to put Midas in low orbit from USAF Missile Test Center, Fla., was believed to have been caused by malfunction in Atlas 19-D.



**THEY
RELY
ON
RADIATION**

Submitted Source of Project Agency: ERM

Earlier, an area subjected to flooding, bays and inlets, the ground-based stations system. Shiphandling and technical demands are under the progress of the Army Signal Research & Development Laboratory (SR&D) and Phalanx is to other great also, some, continues to be the threat.

RADIATION IS a leader in space electronics. Moving system products over the horizon as efficiently as possible.

It goes to help shape information on the the the, saying the the lived, caught by report

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Oliviero, Sandra Mayday & Wava and Pol
also, Cadden etc.



are responsibility and authority in all of NIAA activities which involve biology medicine or metabolism.

The present research effort in this field within NASA appears to be concentrated upon a single specific goal encompassed by Project Mercury at the juncture expense of other equally important goals. The importance of it is so apparent that the National Academy of Sciences has been asked to study aspects of the Project Mercury; he places requests under the jurisdiction of the Office of Life Sciences and that it be coordinated with other agencies of the Life Sciences Division. The results of the above-mentioned research effort, in kind and military industrial and aerospace information, its spending and incidents in other parts or interests or responsibilities. These efforts are on the whole, of excellent quality and should be maintained and continued. They are also well planned and executed, and they are well coordinated with the other related work done in the area and thoughtfully planned broader program of research extending from the most fundamental aspects to their most practical applications. The nucleus of such a national endeavor should be the NASA program in space biology studies and medicine.

The number of competent biological and psychological scientists involved in space research and skilled in the special problems and techniques of the present seriously limited. It is necessary to create a number of career opportunities in this field to a long-term, full-time basis and to increase the number of biologists and physicists in which post graduate research is being conducted.

[illegible]

lives of the Department of Agriculture. This site has a further advantage in that it is perceived by experience as a natural space center which the greater compatibility and the different constitution of the NHI could not make possible. Further plans regarding the facility should be the responsibility of the Director of Life Sciences and his staff who will make specific recommendations to the administration.

A significant signpost of a productive and sustained research effort is the opportunity for interaction among scientists.

of the relevant disciplines. Between these whose interests are in the foundations and those working in the applied aspects of the problem. The need for contact has become essential as research results in the result of the high degree of specialization a hard condition of access and increasing demands and the increasing rate at which new knowledge is accumulating. The obstacles for university which depended upon the transmission by a single word of the information necessary in a new strategy is becoming increasingly difficult to achieve. Some parallel at least be replaced by a direct contact and collaboration among scientists within a single center.

- A limited number of additional vehicles stationed at each of the ports or below NWSA jurisdiction and possibly on and

three or more groups. Each of these groups could be defined according to the special location and this variety of components represented in their lexicons. In the analysis, limited at a maximum with 100 words, the most frequent words were those already assigned natural basic meanings in Italian, situated where structure and place were emphasized through reference to contextual elements. The definitions of the other basic words, the definitions of the other hand, should be primarily representative of the technological and engineering aspects of biology and medicine. They would then be used to establish the differences of meaning of natural words, commonly, this would require that engineering development of specific words be carried out with the aim of giving the representation of basic concepts.

The committee is reluctant to regulate the dimensions of such these facilities should attain or to indicate more precisely the visible consequences it would suggest however that the director would get per

- **Section on Basic Biology.**
- **Section on Medical and Behavioral Sciences.**
- **Section on Applied Medicine and Biology.**

The substantive nature of the program is such that these three reviews is intended to do the respective heading in Section III of the report although considerable latitude in planning should be given to each member.

• **Section on Extramural Program.** This section should be responsible for the administration and in collaboration with the other relevant director(s), and the Director of Life Sciences, the planning of the extramural program.

The Director of Life Sciences also does an advisory committee study up of trends and issues outside the NASA recommended focus and reported to the administrators. Such a committee would correctly report to the Director of Life Sciences or to someone directly to the administrators of the NASA.

The assistant director of the bioscience may well need advisory committees in their specialty. These could be made up of NASA personnel plus outside consultants.

An active and detached research programme on the biological, behavioural and medical causes within NAA's rheumatoid panel, or rheumatoid, of knowledge and responsibility in which the national effort in the field can best be planned, administered and evaluated. The rheumatoid panel should be represented by the highest administrative levels within NAA's and rheumatoid programme in the planning and direction of the entire programme. Its members should be available to contribute and should be given support.

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It is of some interest that the raised expenditure of the communist members compared on an estimate of 20 scenarios and 80 to 94 supporting personnel in maintaining with an internal staff. An overall budget of \$100-200 million of permanent troops must last including weapons and equipment, most would probably be trained in

The size of growth toward an environmental program of the scope outlined above will, of course, be limited by the total budget and the competitive needs of the parent agency. More important perhaps may be the limitation self-imposed by the program directors in recognition of the priority of otherwise pressing research and the other

[illegible]

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In the second 180° the tooth roots, decreasing the size of the chamber as it passes the discharge port, forcing the liquid out.

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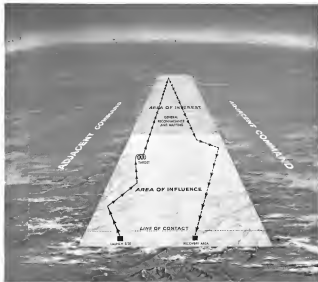
Although missions include reconnaissance and mapping, the most important is target pinpointing. Here it is necessary that the inertial system of the drone be extremely precise, since the target-position information the drone gathers is linked by the externally-guided ballistic missile which is fired on the target. Honeywell achieves such precise performance characteristics through

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Miniature Inertial System surveillance drones



Flight path programmed for a typical advanced drone mission is shown in this diagram. The Honeywell miniature inertial guidance system will direct the aircraft from launch on target and beyond, and back to recovery area without ground commands.

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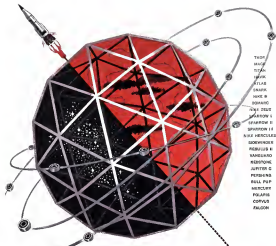
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facilities of NASA or the armed forces in receipt of information in the Life Sciences Program.

The committee, in consensus with scientists generally, believes that the primary purpose of science, which is to increase man's understanding of the universe, is best fulfilled by free exchange of scientific findings, information, and criticism among all scientists. The Congress, in establishing this agency declared "that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." It is this role, the committee recommends that NASA give serious thought to these mechanisms and guarantee which will facilitate free scientific interchange with respect to the Life Sciences program. Among these efforts the committee has considered and which it supports are the following:

- **Enhance use of travel funds** to permit the exchange of information between or directed scientists or among scientists at national or international meetings and conferences, reduced salary restrictions but guided by the value of such interchange to the advancement of knowledge.
- **The sponsorship by NASA** of lectures, seminars and of conferences involving and exchange on topics or in fields where such efforts or opportunities for exchange of information could be of value.
- **The establishment of a policy** of the free reporting of all scientific information obtained in the Life Sciences through the national or international operations of NASA in the open scientific literature. Science regulations which impact on personnel or publications and in the case of grants contracts and fellowship must be concerned with good science and limited to those regulations which are direct interference in national security can be directly denied.

Although work being sought related to problems of space use be conducted in appropriate facilities on earth, it is apparent that many observations must be made in space vehicles. The study of the effect of gravitational or an electric, magnetic, or irregular surface of the earth, of the planets from platforms high above the disturbing influences of the earth's atmosphere is neither. For many times to come, the space available for scientific observations in space vehicles is likely to be strictly limited. By the present time almost all such space and land-based observations are taken in a very short time. The committee is deeply concerned by the opportunity to observe the universe in the future. The fraction of the vehicle at rest or in motion, limited planet elements, use of its computer resources. From a perspective of progress, however, will not provide more, continuous view of the but for years to come, the use of the facilities is likely to be far less than the demand. Proper attention of such space facilities will be very difficult to arrange and certainly cannot always be left solely to the good will of those responsible for the design and operation of launchings, equipment, or to mission conducted in it. It can adjust the largest amount to our role.

Attention may be drawn to the fact that at present few great powers between them enjoy a monopoly of operations in space. Although this fact may be expected some-



Space Radiation Package Tested in Drop

Nuclear emission telemetry vehicle (NERTV) for testing space radiation (SAW New 9, p. 70) was recently tested at a high altitude drop from a USAF Lockheed F-104 jet fighter. Package weighed 71 lb. and was developed by GE's Missile and Space Vehicle Department. NERTV will be launched by NASA's Ares D-3 missile under to 1,000 to 1,500 ft.

Lockheed Satellite Contracts Negotiated

Los Angeles—Contracts totaling \$173 million for work on DynoSat, Atlas and Scout satellites have been negotiated by Air Force with Lockheed, Northrup Corp's Missile and Space Division. This brings Lockheed's contracting total for these programs to more than \$500 million.

Breakdown for the new figure is \$50 million for the DynoSat development satellite, \$50 million for the Atlas advanced warning satellite and \$173 million for the Scout optical reconnaissance satellite. The contracts, to be signed soon, were preceded by letter contracts.

Lockheed said it expects a slight increase in employment as a result of the new contracts.

[illegible]

Space Spurs Cryogenic Avionic Research

New York—Cryogenic electronics, an infant technology of electronic devices and components operating at very low temperatures, appear likely to play an important role in scientific and space vehicle navigation, detection and communications systems, a recent American War Council of 44 science firms and research laboratories indicates.

Initially these advantages are expected to be employed in airborne projects and a restricted number of space applications. Further in the future is the promise of extended space applications for cryogenic equipment, navigation and degraded space environment.

A few of the immediately more attractive applications which are now feasible and will become more interesting as device development progresses are:

- *Long range radar and communications—Aircraft can carry highly sensitive and therefore long-range radar and communications equipment using wave-cooled Miras and parametric amplifiers and can employ liquid helium as

- **Inertial systems**—Navigation and guidance systems with convergent gyroscopes (AW Feb. 1, p. 72), accelerometers and perhaps at some future time guidance computers also may be appropriate for short-life guided missiles and/or ballistics missile submunitions.

- **Infrared/Aircraft and satellite infrared reconnaissance and fire control systems** using detectors cooled to liquid nitrogen (77 K) at atmospheric pressure and cryogenically liquid helium (4.2 K at atmospheric pressure) temperatures are among the first applications. Radiation-sensitive superconducting bolometers may also be applied here. Other advanced sensors include matrix photodiodes and quantum well infrared systems that can also be used in cryogenic environments.
- **Magnetometers**—Aircraft and satellite magnetic surface patrols equipped with superconducting magnetometers or magnetic anomaly detectors are another important application.

Ultimate complete cryogenic system with sensitivities almost unique among cryonic equipment will evolve, according to several firms and military sources questioned by Aviation Week.

The major research progress of a few engineers, and the thinking of a number of others, are already pointed in the direction Crompton desires.

research by the Merits Co., for example, is devoted to developing superconductive components and transfer-enabled the complete cryogenic helices. All-cryogenic systems of interest to Merits and others, include rocket guidance using superconducting position cryogenic sensing and processing capability, and sensor assistance under agreement with several parallel digital data trajectory computers. As all-cryogenic inertial sensors, according to one proponent of such systems, might allow the use of one sacrificial system previously known.

But for the present, cryogenics should be in still in its infancy. It should be primarily a broad research and developmental effort, involving an annual investment of over \$55 million in 24 of the 44 questioned State labs. This research and development must progress, many cryogenics feel, before all cryogenic cryonic systems can be refined. Much more must be learned about superconductivity and superconductive materials, about the behavior of semiconductor and paramagnetic materials at cryogenic temperatures, and about lubrication techniques, these engineers agree.

There is also some firing among scientists working in cyrospace, although it is a minority opinion, that swift development of space studies be

dispensed both interest in and need for ergonomic computer components. Should the tunnel design win wide acceptance and be produced as cheaply as some predict, the reasoning continues, ergonomic components will find only limited applications in computers. This could in turn be reflected as a general slowdown in interest and development of other ergonomic components.

Regimes of the past and extent of eurytopic electronic development, it is likely that eurytopic devices will be introduced in steps before the all-eurytopic system becomes practical, just as semiconductor devices went before the advent of completely monolithic systems. The eurytopic gate, a key device now in research and only in development at many laboratories, will have to prove practical and comparable in other eurytopic low-drift gates, as a typical initial step in all-eurytopic development.

[illegible]

An in-home helium refrigerator is another matter, however. A device needed to continuously cool a cubic foot of cryostat circuits dissipating one watt/ft. as a subject of SOC would measure 15 in. in diameter, 18 in. in length, would weigh 100 lb. and draw 6 in. Hg. 5-hp. compressor would add 300 lb. more, according to a manufacturer of the device.

Screening there are a number of applications in which this difficulty can be alleviated. As an example, an assay could be used for which the assay can be done in a test tube, rather than in a large vessel, which in turn requires less fluid, and a preliminary cooling vortex might not be necessary or desirable. Or in a reaction which is designed to prevent excessive thermal damage from first suspended organisms, the incubation time would be reduced, and the reaction could be stopped immediately by placing in an external cooling bath, refrigeration which could be detected using either infrared or thermocouples.

Cooling requirements may be simplified in space. Matrix engineers point out that the low temperatures required are less severe with the low external temperatures available in space and with poorer conduction losses of the chamber.

Divergent rocket propellants, they observe, might provide a low-temperature environment in the vehicle, for much of the trip at least, without added weight. The small power dissipation of cryogenic currents would cause insignificant heat off of a peroxide fuel.

Of the 44 groups surveyed by Aviation Week, about 30 are in the midst of device research and development, much of it for space or airborne applications (see chart, p. 72). Devices include:

- *Cryocoolers (superconducting) which will have extremely low running drift rates, perhaps as low as 0.0001 deg per hour. These are under study at the time of writing.

Geometric distortions in the technology of very low temperature (below 120K) shrinkages. The primary phenomenon which many organic devices utilize is that of superconductivity, a metal or compound's complete loss of resistance when cooled below its transition temperature (see *shrinkage* note). Many pure metals (mainly poor conductors at room temperature), compounds and alloys display superconducting properties, although these selected constituents may not be superconducting by themselves.

Transition temperatures of superconductors can be reduced by externally applied or internal magnetic fields. For sufficiently large fields exceeding a critical field, a superconductor can be driven out of the superconducting and into the normal, or resistive state. The critical field becomes larger as absolute zero temperature is approached.

This "something," or indeterminacy by definition has little to be employed here even as by the late David Bach, then a young graduate student, in his account of the creation. The system consisted of a wire control made of a superconductor with a relatively high critical field wrapped around a core or pole magnet. Coils with a lower field. Coaxially passing through the control set up fields which are sufficient to push the gate into its closed state. Thus, the coil had a switch which, placed in series with another cylinder, gave us a control of the other, named a multistable. Large numbers using systems were documented.

To increase the speed of the device which is limited by the switching time and the ratio of self-inductance of the control to the mutual self-inductance of the gate, researchers progressed from Bull's original two-wound system to the three thin Arise wire arranged spiral structure.

The device, and other superconductive vacuum-deposited thin film cryogenic devices, have three potential advantages for space applications cited by Martin Co. • Thermal and chemical decomposition are virtually non-existent at cryogenic temperatures.

- Easy completion of continuity of work under less-than-ideal conditions can be made
- Incentives to work and retention is inherent because components reside at their assigned/parent lines with the other team being a solid team.
- Disposition of the components prevents costly realignment and unit organization which would allow the parent to become dispositive components.
- Easy removal of components with the potential for huge recovery starts with short 30000 lbs parent charge of many complex constitutional programs, thus ensuring a minimum of waste time on separate or outside source.

Criteria of superconductivity. The criteria point to criteria involving those (1) measured in the extended magnetic spectrum, which is also used in a phase liquid solution in this mode. The difficulties in controlling the deposition and the need to cool the circuit with liquid helium. Progressively enter some of the advantages obtained above and the possible low cost of making 1,000 systems in a single process, operating.

Success with the carbon has stimulated interest in other conjugated devices both superconducting and non-superconducting. Non-superconducting devices using conjugate environments include infrared detectors and photoconductors from which thermal noise is perfectly eliminated at these solidified temperatures, and MOSes which have very low noise temperatures when cooled to liquid helium temperatures.

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the superconducting system. Present efforts according to RADC are devoted toward devising a cryogenic method for removing extremely small magnetic fields.

• **Accelerometers** (superconducting) which should be highly accurate and sensitive over a wide range from 10^{-4} g up to 10^4 g which are expected to be used in use.

• **Virtual calibration** for satellites, which will provide direct reading of position in orbit and development at Kinetix. A dual vector device, it will not only two positions in space, one based on the actual vector from the earth's center to the satellite, the other a vector perpendicular to this. The resulting mechanism still properties, is superconducting.

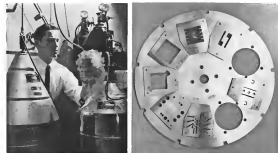
• **Reluctance** (superconducting) elements sensitive to induction, and possibly superconductive in the infrared region. These devices will utilize the extreme sensitivity of a superconductor to an externally applied field and should be excellent induction detectors.

• **Micro-wave** (superconducting) which should be low-loss devices capable of operating up to 1 kmc. New lines involving an obtained in transition from the superconducting to the normal state. Devices groups indicated on the chart. Arthur Little is investigating

the response of superconductors to very high frequency fields under a contract from Air Force Cambridge Research Center in connection with the latter's interest in a microwave mixer.

• **Antennas** (superconducting), which should have excellent frequency response because of low resistance to current in vacuum. The antennas would consist of a simple superconducting feed circuit with a small coil mounted in series with one element of the tank and brought outside the shielding. The coil would be extremely sensitive to induction and would couple energy into the loop.

• **Electrostatic** (superconducting) capable of providing stable magnetic fields for Maser and at the same time consuming little power, occupying no significant space and contributing negligible weight to a device (AEC Feb. 15 p. 70). These devices will be primarily in conjunction with Maser work at Atomic Instruments, Hughes, Jet Propulsion Laboratory, and Lincoln Laboratory. Maser objective is to have superconductors with high critical fields (operating temperature of 4° K) and capable of being fabricated into wire. Under contract to Lincoln Laboratory, Battelle Memorial Institute is investigating a niobium-tin compound and if this material can be pressed into wire it should provide critical fields four times those of this alloy.



VAPORIZING NITROGEN in dewar first at the Mott Co. (57) provides 77K temperatures for tests of vacuum-deposited specimens. Circular holders and assembly units for depositing the flip flop at Space Technology Laboratories, Inc. (right) are shown left first use.

critical fields four times those of this alloy.

- **Mixers**, capable of operating in the millimeter wave region or with higher pen-hertzable products or better stages of frequency. Among the more exotic types is a cyclotron resonance Maser at the planning stage at Lincoln Laboratory. It will use superconductors as active materials, will be trouble and possibly work from millimeter to infrared regions.
- **High-powered** parametric amplifiers, normally, capable of noise figures of about 1 db at room temperature, which can provide even more sensitive parametric fields four times those of this alloy.

facilities testing Maser because of the reduction in thermal noise when cooled to liquid nitrogen temperatures.

• **Superconducting computer elements**, including thin film systems. Shikiguchi and co-workers have been and are being developed at RCA, IBM and Arthur Little.

• **Nonlinear** conducting computing elements, such as CRYOSAR (low temperature) Switching by Atomic Research Incorporated, developed at Lincoln Laboratory. CRYOSAR is a two-terminal computer element whose operation is based on impact ionization in superconductors at liquid helium temperatures. In operation, transfer to that of a gas discharge tube, such as abrupt changes in resistance produced by light rays across a superconductor. CRYOSAR research efforts are possible.

Other Projects

Other cryogenic components and devices in various stages of research or development are Acoustic Undersea and Inertial Systems (Atomic Instruments Laboratory) superconducting transformers and transmission lines (IBM), superconducting cables (Hughes), microwave superconducting switches (RCA and Hughes), kerr-type gratings (Hughes), low-temperature photoconductors (RCA and Kodak), infrared detectors (Westinghouse, WADC), Hughes and cryogenic switches (Naval Research Council). Besides these special cryogenic devices, standard components can be made with new and improved properties.

ties when used at cryogenic temperatures, according to W. C. Dooling, Jr. head of the solid state research group at Bendix Research Laboratories. Available techniques applied in research and development. He says that the research group because the thermal losses are breakdown or through infrared. Unique available material are possible in such systems, he says.

Along these lines, RADC is conducting a cryogenic program aimed at more immediate use of active components cooled to liquid nitrogen temperatures. In operating systems equivalent at lower temperatures and not allowing



LOW TEMPERATURE operating ranges of various superconducting and quantum electronic cryogenic devices as well as special oxide transistors and perovskites are indicated in chart.

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large temperature fluctuations, RADIC engineers report to obtain improved performance and better reliability than possible at room temperatures.

The preservative effect of low trace particles Densip adds might prevent deterioration of osseous components.

Materials/Methods

The importance of materials in organic electronics is indicated by the groups among the 44 questioned which are studying materials. The number breaks down as follows: experimental materials—13, simulations—2, and theoretical materials—3.

In superconduction, the prime materials of magnetic electronic energy groups report efforts to find new superconductors to raise transition temperatures of known alloys or to find new materials with higher transition temperatures (the higher temperature approach), to find materials with sharp superconducting transitions, to obtain pure materials with low critical magnetic fields (the thin crustal) or to obtain materials with high critical fields (the crustal).

Among the superconducting oxide
ruth and the laboratories where they
are studied are oxides and its com-
pounds boron-nitrogen and car-
bons compounds (Kuper) oxides
diamond, carbon nitride and nitro-
gen nitride (Bell Telephone Labo-
ratory), the lead, mercury, nickel and
titanium (MIT) oxides, the alumi-
num and zinc alloys (Rutgers Uni-
versity) and Gallium (Purdue Technol-
ogy) Institute.

Cooling Mechanisms

None of the organizations questioned are working on cooling mechanisms for magnetic dictionaries. Ohio State University, for instance, is continuing on conventional cooling mechanisms under contract to RADC. The efforts being studied include some considered to be below present standards, but which supply logistic advantages of simplicity, reliability and convenience in handling and use of non-strategic materials. RADC, via Ohio State, is studying magnetothermal and endothermic chemical reaction effects.

If superconductors can be found with transition temperatures near the higher temperatures of liquid hydrogen (20 K), cooling problems may be eased for superconducting devices. To date the highest reported transition temperature is for niobium (about 9 K). One scientist suggests operation of liquid neon (27 K) refrigerating systems although the cost could prove prohibitive.

Air Products, Inc., a manufacturer of cryogenic systems for cooling electronic devices, is urging owners people to remove 75 to 400 systems for asbestos abatement.

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seign Institute of Technology, Concord, a division of General Dynamics Corp., General Electric Co. Computer Laboratory, Palo Alto, Calif., and General Dynamics Laboratory, Dayton, Ohio. General Electric Co. (Electronic and Infrared Laboratories), International Business Machines Corp., Jet Propulsion Laboratory of California Institute of Technology, Pasadena, in view of General Dynamics, Inc., Lincoln Laboratory of Massachusetts Institute of Technology, Lowell State University, and the Martin Co. (Electronic and IRAS divisions). Also, Massachusetts Institute of Technology (Electrical Engineering Computer Component), Minneapolis-Mercantile Bankers Co. (Aeronautical Division), National Bureau of Standards, Radio Standards Laboratory, Boulder, Colo., New York University (College of Engineering), Ohio State University (Aerospace Laboratory and Department of Chemistry), Pennsylvania State University (Computer Laboratory), Purdue University (School of Electrical Engineering), Radio Corp. of America, Rome Air Development Center, Rutgers University (Physics Department), Space Technology Laboratories, Inc., (Physical Research Laboratory), Sperry Corporation, (Surface

Acoustics, Marine, Electronic Table, and Communications Division) and the Sperry Microwave Electronics Co., Space Institute of Technology (Department of Physics, U. S. Army Signal Research and Development Laboratory, Ft. Monmouth, N.J., U. S. Naval Postgraduate School (Department of Physics), Monterey, Calif., University of California (Lawrence Scientific Laboratory), University of Kansas (Department of Chemical Engineering), University of Michigan (Solid-State Division Laboratory of Electrical Engineering Department), University of North Carolina (Vigyan Polymer Institute), Westinghouse Electric Corp. (Research Division), and Wright Air Development Division.

It includes their foreign laboratories participated in the survey. They are: National Physical Laboratory, Tollyington, Middlesex, England, National Research Council, Ottawa, Canada, and Physical-Technical Federal Institute, Barmen, Germany. Information about electronic research at several companies which did not participate in the survey but are mentioned here came from company spokesmen or sources outside the firm.

which assumes only one-half inch in diameter and features a "ball-bearing" characteristic. Lamp was developed for use in wing tip of military aircraft.

• **Castrol**, the Lubricants Division of Cities Union Inc., for protection of the smallest complete low-stage engine for free construction. The horizontally seated unit measures 0.57 in. in diameter and 0.27 in. thick.

• **Boehr Research Laboratories** for development of a miniature hydraulic cam motor, measuring only 1 in. in diameter and 1 in. long, which develops 0.3 hp, for use in space vehicle applications.

FILTER CENTER

• **Probing Upper Atmosphere**—Electron density at the upper atmosphere above the F2 region will be studied with satellite probe and ground control equipment to be developed jointly by the General Radio Propagation Laboratory of the National Bureau of Standards and Aerospace Instruments Laboratory. The Propagation Laboratory will establish experimental methods and interpret data, AIRC designs, develop and fabricate antennas and ground checkout hardware, ground display equipment.

• **Space Guidance Team**—Team of former Army, Navy, Air Force, Agency scientists, perhaps 15 in number and headed by Dr. Frederick M. Mueller, previously deputy director of ARMA Guidance and Control Laboratory, will be the nucleus of AeroSpace Electronics Corp., Hawthorne. The team will set up in Beloit, Wisconsin, Corp., College Point, N. Y., will handle research, development and manufacture of guidance control systems and space vehicles.

• **Spaced on the Dotted Line**—Major contract awards recently announced by various manufacturers include: **Boeing Electronics**, division of the Boeing Aircraft Co., San Diego, has been awarded three contracts totaling more than \$1.3 million for Sikorsky for redesigning the concept of multiple use of an additional quantity of AN/APN-37, including radar, spin and jet ejector for use in Sikorsky's Navy helicopters.

• **Thermal Electronics Corp.**, El Segundo, Calif., is to deliver two types of power supplies to aerotech ground support equipment for the Boeing range under a \$600,000 contract from Boeing Aerospace Co. Accelerated scheduling will be delivered within six months.

• **Collins Radio Co.**, Cedar Rapids, Iowa, will produce medium VHF communication and navigation equipment for the Air Force under a \$1.1 million contract.

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AC Seeks and Solves the Age-Old Problem—Inspired by GM's pledge to contribute heavily to our national defense, AC, an acknowledged leader in the new technology, plans to reach far beyond such accomplishments as Acheiver mental guidance systems. / This is AC QUESTMANSHIP. It's an exciting scientific quest for new ideas, components and systems . . . to promote AC's challenging projects in guidance, navigation, control and detection. / Mr. Jack Blinn, AC Director of Field Service, believes his department's Career Development Program "offers young engineers world wide opportunities in the practice of Questmanship." They learn a product from its technological theory through its operational deployment. Following this training, "they utilize their own agency to support AC products in the field, with more effective technical liaison through training, publications, maintenance engineering, and logistics." / You may qualify for this special training, if you have a B.S. in the electronics, scientific, electrical or mechanical fields. Special opportunities also exist at AC for men with M.S. and Ph.D. degrees. If you are a "seeker and solver," write the Director of Scientific and Professional Employment, Mr. Robert Allen, Oak Creek Plant, Box 746, South Milwaukee, Wisconsin.

Bell Laboratories Employee Wins Annual Miniaturization Award

New York—Donald A. McLean of Bell Telephone Laboratories was named winner of the 1970 Miniaturization Award Competition last week for his development of techniques for making thin integrated circuits, consisting of epitaxial, transistor and interconnections, all of thickness in the order of 0.001 in. (AW Sept. 16, p. 75).

The annual competition is sponsored by Motorola Products Division Inc., Kansas, Mo. Antenne Wren was one of 10 organizations or persons awarded Certificates of Excellence in the 1970 Miniaturization Award Competition. Antenne Wren was selected for having made "significant contributions in miniaturization by seeking out, using, using and reporting on significant achievements in this field. Because up-to-the-minute knowledge of new ideas of others is a powerful stimulus to the creative thinking of engineers and scientists, Antenne Wren has stimulated research and development in micro-circuits and microelectronics."

Other recipients of Certificates of Excellence include:

• **Dr. Jerome J. Ternan**, General Electric Research Laboratories, for his contribution to the development of the tunnel diode.

• **Jack S. Kilby**, Texas Instruments, Inc., for his contribution to the development of complex integrated circuits using a single crystal of monocrystalline silicon.

• **Paulie Steinbock**, Texas Instruments, Inc., for the development of monocrystalline silicon as a material for the space of a monocrystalline silicon diode.

• **Malcolm R. Kelly** and **Robert L. Kelly**, Motorola Products Division Inc., for the development of the world's smallest monocrystalline silicon diode, which has long shelf life and low operating under extreme environmental conditions.

• **Col. Charles H. Lewis**, headquarters Air Research and Development Command, and **William H. Lewis**, Air Research and Development Command, for the development of a monocrystalline silicon diode and developing the monocrystalline silicon diode (AW Sept. 16, p. 75).

• **Edna C. Eklund**, Massachusetts Institute of Technology Instrumentation Laboratory, and **Samuel A. French**, French American, for the development of the welded joint fabrication technique which made it possible to reduce the size of the Polaris missile guidance digital computer to about one-quarter its former size and about one-half its power weight (AW Aug. 24, p. 104).

• **General Electric Co.**, Milwaukee, Wis., for the development of the smallest 150 watt bulb ever made.



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Sikorsky's S-57 proposed would use counterbalanced rotor blades for vertical takeoff and landing, and would be powered by a Pratt & Whitney J62 turbojet in horizontal high-speed flight. Rotor blades are housed lengthwise in fuselage during cruise phase.



Rotor would be powered by an electric fan to keep it in cruise position. Then, after a shift to drive a compressor which would add air to those jets at the tip of the rotor blade. USAF tested design, construction and test of wind tunnel model.

Sikorsky S-57 Jet VTOL Stores Rotor in Fuselage



Wing leading edge of the S-57 (AWJ-14, p. 52) is slightly bowed in the swept back direction. This offers advantages at high speed and minimizes drag problems that are prone to cause transonic effects at about Mach 1.8. The S-57 would avoid serious stall by through the transonic surge, Sikorsky says. USAF and Navy have studied the S-57 design concept.



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SHORELY S-60, general is two approximating engines in the innermost of its four powered cross which will be dropped to very perhaps in just 10 tons. Sikorsky's fast to heat cross will be the S-60, due to be this year.

Aviation Week Pilot Reports

S-60 Demonstrates Crane Feasibility

By Robert I. Stadfield

Stadfield, Conn.—Sikorsky's S-60 flying over the water, with demonstration the vertical lift crane concept and potential to carry and personnel carrying, techniques, and commercial and military capabilities.

Good, reliable—coupled to its lifting and piloting—capabilities loading and unloading.

Efficiency of the S-60 was observed by the Aviation Week pilot during flying first to a passenger in the 21-foot, detachable, experimental "people pod" and then in an operator of the power-driven, multi-engine, 50-cu-in. which carries in 100 lb. and can hold a 5-ton payload.

The aircraft was built around existing components of the production S-60, including engines, fuel systems, oil clutches, gear and gear boxes. The only the structure and cockpit are different. The development represents a Sikorsky experiment of more than 52 million Navy's Bureau of Aeronautics furnished build components (NAV Apts. 38, 1999, p. 29).

Perceptions are two Pratt & Whit-

ney R3500-54s, each generating 1,900 hp, normal rated and 2,100 hp, which stand at 2,780 rpm. That grade is 115, 145 inches. Empty weight is 75,511 lb., maximum gross weight is 34,500 lb., still as cargo is 120 and so.

The S-60 is the forerunner of a family of helicopter-powered cranes de-

signed by Sikorsky in various tactical roles that will provide a minimum payload of up to 50 tons, maximum flexibility to transport any type of cargo and do any type of lifting, hauling or towing in the minimum time and at minimum cost.

Test of these Sikorsky S-60s, will



HOOPER of Elmer John, with the crane, is loaded by S-60. The helicopter can hold a five-ton payload and cross at 100 lb. S-60 on cargo is 210 and so.



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Other advanced research and development programs are aimed vital to technological progress in space, military weaponry and industry include:

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- Heat Rejection in Space
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- Optical Tracking and Guidance
- Space Command and Control Systems
- Expanding Wire Research

EOS has personnel experience in Physics, Mathematics and Engineering.



ELECTRO-OPTICAL SYSTEMS, INC. 126 NORTH VINEY AVE. PASADENA, CALIFORNIA

used as a shock absorber. During this flight company was testing four air situations used with California parachutes.

The S-60 plus pad and passengers, grossed about 10,000 lb. at takeoff. Outside air temperature at the Stratford glider was 60° with winds from the west at 10 kt. and gusts to 40 kt.

Pad Flight

The pad is a "brake-type" of vehicle, with an almost continuous expansion of glass windows. There are two tires on each side plus one in the rear, facing the tail gate. Four wheel-type seats also face aft. 16 basket-type canopy seats are arranged in two rows of eight back to back, in the center of the pad. Visibility to all arms is excellent.

Nose level is fairly high once the two pistons expand and up, though we didn't have to shut to be heard. "Cave" was smooth there was no discomfort while moving out to main-dep position.

Flight in the pad was made from a basket to usual controls of the glider at an altitude of 2,000 ft. where, with an instrument in the instrument pod, it was slightly better. There was little pressure evident and, despite the strong wind, a movement of vibration was apparent. At one engine, and the pad side with the helicopter through the rough air. Initial test flight with

this type of absorber did produce a noticeable vibration and side-to-side shudder.

S-60 does not provide for attaching of loads on the head ports. This, of course, is comparable to carrying a load into the air in a helicopter. Some pilots have felt that the ability to attach would be a desirable feature and also feel that while the present method of supporting cargo on four cables is completely adequate additional cables could be used to eliminate all swaying.

Pilots with only checkout experience have had little difficulty in making successful pickups and drops according to Standard. Present operation, with the good visibility offered by the canopy, poses no problem.

During flight from the cockpit, this Aviator Wing pilot was accompanied by John P. Smith, company test pilot. The cockpit is suspended below the main part of the fuselage. The pilot, who sits on the left, is provided with a control and two sets of controls, working about for one operator. The aircraft facing forward with cargo and landing air in full view. The cockpit is provided with conventional forward-looking controls. (The two power S-60, by comparison, will have a fixed seat to the rear.)

Two pump seats are provided for ad-

ditional crew. Two landing lights, one spot and one flood type, are located on the bottom of the cockpit with 360 degree in count down visibility at night. Branded instruments are provided for both pilots with altimeter, tachometer and manifold pressure gauges provided for accurate test. Basic ASR (Automatic Stabilization) equipment is installed, monitoring pitch, roll and yaw with pressure for altitude and triler controls. Two large nose-view mirrors also are mounted adjacent to each pilot.

The big crane, looking somewhat like a growing machine, was moved easily to main-dep position where suspension was elevated at 30 in. manifold pressure and 2,200 rpm. Automatic stabilization equipment was engaged before takeoff. The S-60 was clean, and having been removed, a reading of the lowest John Smith-to-vehicle marks, on meter, was needed for pickup. Module travel configuration weighed about 600 lb.

Flight Characteristics

S-60 was lifted off at 30 in. and 2,600 rpm, feet off rubber pads, and was leveled at 15 ft. Stability was just noticed. With manifold pressure reduced to 31 in., the aircraft could almost hold position. Loads at 45 in. and 2,800 rpm, stopped reducing 70 lb., level single-engine speed. Rate of climb was 2,000 fpm.

Again, the only landing was held in the climb, there was no need to touch the rubber pads.

The rotorcraft normally cruises at 190 lb. During level flight at 2,000 ft., power is 25 in. and 1,600 rpm, the S-60 indicated 50 lb. Despite changes in the helicopter was able to maintain "hands-off" flight for brief periods. With power reduced to 22 in. and holding 1,600 rpm, descent of 1,500 fpm was made in 58 lb. indicated.

Along with the strong wind for pickup of the lowest John Smith, the pilot's seat was launched about. Call for a pilot's seat was moved with the test.

In the structure the rightmost pilot flew the helicopter while the other stick was removed and inserted into a right position, ahead of the nose seat was facing pilot. There is a small fuselage rest, in the right of the left-hand pilot, which is coupled into the ASE, and which has power assistance, during tests, but was not operable during this flight.

The S-60 was brought down over the main-dep trailer, while "waiting" over the load the brake was put on to keep the tail from swaying. A small crew loaded up in the four "wind" ports of the trailer within one minute. Loads are moved in the vicinity of the center of gravity, not against due to loading



MERISKY ARTIST'S CONCEPTION shows a two-turbine S-60 using a dummy truck load to supply an initial configuration into. The S-60 will carry an eight-ton payload.



S-60 CAN LOWER its cargo back from a hovering position, work up a two-ton weight in cargo hold and fly away, or it can drop there along the ground in a landing operation.

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ize at a maximum. Stability of the S-60 was pronounced during the short flight-patrols with one of the ASH—other which the aircraft was loaded and the immediate speed, detached.

With the use of map an adjustable collar, any type of head can be made secure to the S-60. As a production version (the S-64) adjustable collar would be built into the aircraft, incorporated into a shade reflect type apparatus to supply further cargo loading and unloading.

Hydraulic Heat

The engine also is provided with a hydraulically operated heat and a heat, that can either be manually operated from the ground or electrically operated from the cockpit. The heat is located directly under the main gear box, at approximately the center of gravity of the S-60. Hydraulic pump is continuously being modified to assure maximum reliability.

The S-60 has been on static test (grounded in ground) and has held 17,000 lb. of tension with excess power for emergency. The 12,000 lb. gross weight about a 12 day, wind-down condition.

Which installed in the helicopter is designed for towing operations up to 30,000 lb. of tow load.

The aircraft was first flown on Mar. 28, 1959. Cargo first were carried or towed included ladders, fuel tanks, fuel tanks, bombs, trucks, water tanks (100 gal.), radio control trucks, auto-windings, tires, and 35 S-60 helicopter installed from Stratford to Skidoo's Redpoint, Conn., plant. At a rescue-wrecker the S-60 has towed out 600 ft. of cable and manhandling gear during a Navy demonstration.

Hypersonic Tunnel Exceeds 12,000 mph.

Hypersonic wind tunnel capable of speeds in excess of 12,000 mph and temperatures greater than 14,000° is in operation at Stanford University's Aeronautical Engineering Laboratory.

Financed by six aircraft firms—Convair Division of General Dynamics Corp., Douglas Aircraft Co., Hughes Aircraft Co., Lockheed Aircraft Corp., North American Aviation, Inc., and Northrup Corp.—the tunnel's research program is supported under contract with the Air Force Arnold Engineering Development Center, Tullahoma, Tenn.

A bank of 135 experiment stores up electrical energy sufficient to supply power for a 200,000-watt arc spark which heats air to supersonic pressure in 20,000 psi. Vacuum tank pressure is released to accelerate atmospheric pressure prior to each "shot" which lasts 0.02 sec.



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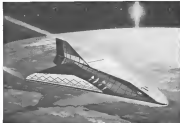
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Washington—Following is a list of positions established by the National Aeronautics and Space Administration under Subsection (2), Section 201(b) of the National Aeronautics and Space Act of 1958 authorizing appointment of scientific, engineering and administrative personnel at various above, normal and senior levels.

The statute provides that the NPSA administrator "may appoint and fix the compensation (up to a limit of \$10,000 a year or up to a limit of \$21,000 a year for a maximum of 10 positions) of one or more than 750 of the scientific, engineering and administrative personnel of the Administration." It adds that "in the event the administrator deems such action necessary to correct specific qualified scientific and engineering talent, he may establish the administrative grade for scientific and engineering personnel without previous service in the federal government at a level is to two grades higher than the grade provided for such personnel under the Classification Act of 1949."

- **Hunter & Hawley**, 111,900, director of research programs.
- **John A. Johnson**, 117,600, general manager.
- **Kelly & Kline**, 118,000, director of research.
- **Lester E. Smith**, 119,000, chairman.

TABLE 1. Summary of the 1997-1998 season

[illegible]

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[illegible][illegible][illegible]

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AVIATION WEEK's transport editorial department will supplement "Facts & Figures" with staff articles covering key subjects on airline and air transport development.

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Aviation Week
and Space Technology

Lockheed Expands Abroad as Partner

By Richard Sweeney

Los Angeles—Lockheed Aircraft International, Inc., is setting a trend to develop partners in foreign U.S. technical know-how and cash in joint ventures with foreign companies to produce hardware or services.

LAI joins with existing foreign companies or firms acquired especially for the particular enterprise. LAI takes an equity position only if money is needed and the entire proposition meets strict business standards.

When the company was established in April, 1959 as a wholly-owned subsidiary of Lockheed Aircraft Corp., it was named of capital for capital in foreign activities. No funds were set with each deal to be handled only internally. Since all Lockheed funds come from the same corporate pool, Lockheed Aircraft International was agreed upon to provide for the part out firm, and payments are made at that level.

Although LAI's corporate management is responsible for its overall line at the end of the fiscal year, ultimate responsibility is to account to Lockheed Aircraft Corp., which remains directly to the latter's stockholders.

Foreign Efforts

All divisions of Lockheed Aircraft Corp. are active in foreign markets. But LAI has a different position in foreign efforts (over and above capital investment) than the Lockheed divisions, in that efforts are directed to:

- **Lead fields** where activities can include one of the entire spectrum of capabilities existing within the parent corporation and its divisions and which is profitable.
- **Handle** certain foreign relations which Lockheed has had for some time.
- **Serve** as a medium of exchange for technical knowledge between Lockheed and foreign companies.
- **Assist** divisions of the parent corporation in foreign sales promotion of their products or services.

Advisory Services

LAI is intended to offer technical and advisory services in engineering, manufacturing, national control, production, managerial training and long-range economic planning in fields where the parent firm has capabilities, plan the financial support and guidance is needed in taking an equity position.

A financial interest does not, however, necessarily mean LAI handles

all of these services. Nor is it necessary for LAI to assume an equity position in a foreign company to handle all or part of these services.

In addition to offering technical services involved in new product development or foreign markets, LAI also could act as agent for service divisions of Lockheed Aircraft Corp., such as Lockheed Air Terminal (import development and management) and Lockheed Air Service (aircraft maintenance for foreign military fleets as help in setting up maintenance systems to be operated by foreign personnel).

World Activities

Parts of the world and fields where LAI has been active since its founding have been:

- **Brazil**—LAI electronics and radar technology have completed involving Brazilian an air transport system, a small operation of sub-sonic equipment.
- **Argentina**—LAI is exploring the possibility of joining with an Argentine company to form an aircraft manufacturing firm there.
- **Turkey**—LAI is in negotiation with THT, the Turkish airline, for establishment of a maintenance center at Istanbul.
- **India**—LAI has been asked to submit a proposal for design of a commercial turbo-prop transport and a separate proposal for its manufacture in India, for local use in that country.
- **Thailand and Indonesia**—LAI is discussing design of possible activities for aircraft air transport in both countries.
- **Japan**—LAI represents Lockheed in terms of manufacture of the P-1V-7 and forthcoming production of the R-104 in Japan. This enterprise is a carrier from other years when the agreement began with Lockheed Aircraft Service Overseas in T-35 maintenance and production.
- **Italy**—LAI has negotiated an agreement with Macchi whereby a light aircraft plant will be produced in Italy, and LAI has purchased a substantial amount of stock of Aeromobili Macchi S.p.A.
- **Mexico**—Lockheed Aircraft Corp. formed a partnership with Mexican interests in 1958, with the initial project being the manufacture in Mexico of a light utility airplane designed to operate from the rough, short runways of high altitudes which predominate throughout Mexico and South America. This is the same airplane which will be built in Italy by Macchi. While LAI was

formed, Lockheed Aircraft Corp. transferred its stock in the Mexican concern—Lockheed Aero-Mex S. A.—which has a majority of Mexican interests represented by Alfredo Rodriguez, former president of Mexico, and Juan F. Amador, Mexican governmental patron and engineer.

Technical Experts

In line with its major mission, LAI has technical experts in each of its fields of interest, who analyze scientific prospective deals to assess the overall requirements plus the return which may be expected on any investment.

LAI's technical staff includes experts in aerodynamic engineering, instrumentation, facilities (including construction, site, accounting purchasing and planning).

LAI also uses services of persons familiar with the nature when it is conducting existing business. These include contributions concerning legal and political aspects involved in doing business in the particular nation, since each foreign government usually has its own strict rules on how much outside capital may be received and who must hold how much of a company interest. Usually, these persons also know the proper methods for foreign negotiations, and the required protocol.

When LAI is forming a new enterprise, there are additional factors which enter the consideration, such as the possibility of going on to become one of the divisions of the parent corporation. LAI technical staff is too small to accomplish detail engineering as particular projects which it is necessary, therefore, this usually is subcontracted by LAI and its foreign partner in stock, as the Lockheed Aircraft Corp. divisions.

Flare Market

The small utility airplane to be built in Mexico (and Italy) is an example. Lockheed Aero-Mex knew there was a market for this type of airplane, but the firm was not established to start from scratch in design, light test and production. Therefore, the design, light test and certification of the aircraft, design and construction of tooling were subcontracted to Lockheed's Georgia Division.

Georgia Division contracted for a gross price and according to Lockheed's accurate specifications, to deliver complete and approved production drawings and specifications to be used in Mexico, an FAA-approved type cer-

release, the prototype engine, and supporting activities to the Mexico City. General Dynamics retains no in-house or contract rights in design whatsoever.

Conditions under which LAI and its foreign partners can place business with the divisions of Lockheed Aircraft Corp. vary, and include:

- Where more than one division is capable of doing a job, bids from each may be taken before the contract is placed. Thus, California and Georgia Divisions may both bid on the same engine design proposal.

- Contract may be given to a particular division whose personnel and facilities are more readily available to do the job or other aspects being equal.

- Where only one division has the capability, to do the job, or where one division is to a large extent to do the job by virtue of its past experience in specific areas of a general field, the contract may be placed directly.

Divisional Relations

Relations between LAI and the divisions of Lockheed Corp. are mutually fluid, and work both ways—Lockheed divisions may bring business directly to LAI, or indirectly to LAI where a possible opening exists in which LAI might be interested, as well as receiving business from LAI.

During foreign negotiations LAI can act directly as a sales agent for the products of Lockheed Aircraft Corp. divisions, but only when the division specifically asks LAI to do so. However, this does not prevent LAI from going along with leads for the various divisions' products and notifying the division regarding prospects. Here, a division may ask that LAI act as its agent and try to sell the product or may take over the sales activity itself.

LAI would be paid for its work, when acting on behalf of Lockheed divisions, but there is no set fee and each case is negotiated separately with the division involved. There could be cases where LAI actually would make no profit from the activity, and those where LAI might not even cover its expenses as far as fees.

How LAI and a foreign partner get together is flexible. LAI may approach a foreign company or the latter may approach LAI. Not it is responsible for individuals to see as a foreign company and approach LAI with its friendly suit.

Or, LAI may be a possible deal and seek out individuals to form the foreign company part of the enterprise.

J. Kenneth Hall has been president of LAI since its start, assuming the post from the presidency of Lockheed Aircraft Service, a job he held from the formation of that organization in 1947.

Two graduates of LAI who went from LAI as J. W. Clarno, W. D. Hammer and P. M. Wilson, W. Scott McGilley, former Lockheed Aircraft Corp. international development manager, also is an LAI vice president.

In 1951, Lockheed Aircraft Service (Oxnard) started a program of technical assistance with Kawasaki Aircraft Co., Ltd., at Gifu, Japan, to provide skills acquired by technical Japan-based U.S. soldiers, jet aircraft. Kawasaki was able to do the job announced within one year. In 1954, Lockheed helped Kawasaki set up a jet engine overhaul in Japan, and the contract was completed in 85 months.

In 1955, Lockheed helped Kawasaki set up for production of T-33 jet trainer aircraft, including construction of complete manufacturing facilities, training 1,500 Japanese technicians, providing management training and technical assistance.

Key Figure

Hall was a key figure in setting up the T-33 production, his work involving technical and legal negotiations as well as establishing the manufacturing facility.

In 1956, Lockheed contracted to provide technical assistance for Kawasaki and Shin Meiwa Industries, Ltd., for manufacture of J-207 amphibious patrol planes, with Kawasaki in prime contractor and Shin Meiwa as major subcontractor.

Since previous dealings between Japan and Lockheed had involved Hall and his staff when an agreement was signed last month for production of F-104 fighters in Japan, this contract was placed under the management of LAI which Hall now heads. The agreement between LAI and Mitsubishi Heavy Industries Company, Ltd., is the only exception to the pattern of F-104 foreign program management, which usually stays with California Division of Lockheed Aircraft Corp.

New Offerings

Am Industries, Inc., in Dallas, N. Y., engaged in the manufacture of electronic and mechanical components, sub-assemblies and special devices for use in the missile and aerospace fields. A subsidiary provides engineering, manufacturing and assembly services. Offering in 1960/61 shares of common stock, for public sale at \$5.75 per share. Proceeds will be used to discharge current indebtedness, pay advances to the subsidiary, to purchase additional equipment for working capital.

Krythane Electronics Company, Inc., Newark, N. J., engaged (under Delta Inc. last Jan. 8, 1960, on Jan. 10) set up all the outstanding stock of

The Krythane Electronics Co., Inc. (contractor) engaged in the manufacture and sale of quartz crystals and through a New York subsidiary engaged in the manufacture and sale of precision electronic tubes. Offering in 1960/61 shares of common stock, for public sale at \$5.75 per share. Proceeds will be used for the account of the company, and 66,666 outstanding shares by the holder thereof. The offering to be made at \$5.75 per share, minimum bid value of outstanding shares is estimated at \$300,000. Proceeds of the sale of the 133,334 shares will be used for additional equipment and working capital, and development, balance for working capital purposes.

International Receptor Corp., El Segundo, Calif., engaged in the development, manufacture and sale of semi-conductor devices. Offering in 120,000 shares of common stock, 60,000 shares to be offered for public sale for the account of the company, and 60,000 outstanding shares by the present holder thereof, offering price and underwriting terms to be supplied in memorandum. Proceeds of the company's sale of 60,000 shares will be used for equipment for the manufacture of new products, for carrying out research and development of finished products, for additional capital on projects in foreign companies, balance will be added to working capital to finance expanded operations.

Reisel & Co., Inc., Pelham Manor, N. Y., engaged in the design, manufacture and sale of electronic components, known as filters in filter networks and production or cash. Offering in 280,000 shares of common stock, for public sale at \$5.75 per share, an additional 16,000 shares will be offered pursuant to the company's restricted stock option plan. Proceeds will be used to pay the company's \$100,000 bank loan for the manufacture of magnetic amplifiers and the establishment of a new crystal filter business, for the purchase of new automatic testing and testing and production equipment, balance will be added to working capital.

Calder Radio Co., Cedar Rapids, Iowa, engaged in the design, development, manufacture and sale of special-use radio communication equipment. Offering in 512,000 shares of convertible subordinated debentures, due 1966 for public sale, interest and conversion rates, public offering price and underwriting terms to be supplied in memorandum. Proceeds will be added to general funds and will be used as needed.

Tuel Research and Engineering Corp., Beverly Hills, Calif., engaged in June, 1959, in the research (to

initiation) major in August, 1959, in three California corporations. Company is principally engaged in the design and fabrication of predictive testing, the development and construction of high speed computer simulation systems, design, ground support equipment and ground handling equipment, in project design and engineering the production of stainless steel laminar flow air ducts and wind tunnel components. Offering in 500,000 shares of common stock, for public sale, offering price and underwriting terms to be supplied in memorandum.

In February, 1960, the company contracted to acquire all the outstanding stock of Heflinger Manufacturing Co. and 70% of the outstanding stock of Windsor Lock, Conn. Aggregate price of the stock, a \$5,041,405.55, \$5,041,405.55 possible in cash and \$1,578,553 possible in common stock. Of the proceeds of the sale \$3,615,000 will be used to pay the cash portion of the purchase price, remainder of the proceeds will be added to working capital. Sellers of the stock are G. H. A. Heflinger and C. G. Heflinger, Vice R. Heflinger and C. G. Heflinger, trustees.

Seismic-Danner Corp., Concord, Calif., engaged in the research and development of finished products, the sale of electronic and electro-mechanical instruments and systems. Offering in 447,700 shares of common stock, for public sale, offering price and underwriting terms to be supplied in memorandum.

Under an agreement dated January, 1960, the company will acquire all of the outstanding capital stock of Danner Scientific Co. in exchange for the 447,700 shares of the company's stock, shares will be delivered to the purchaser of all of Danner's outstanding stock, who will cause the shares to be delivered to the holders prior to public distribution.

Seremoni, Inc., Alexandria, Va., engaged in the design, development, manufacture and sale of certain electronic and electro-mechanical systems, instruments and components. Offering in 70,000 shares of common stock, for subscription in common stockholders at the rate of one new share for each five shares held, interest rate and subscription price to be supplied in memorandum. Offering also includes warrants for the purchase of 24,000 common shares, and the shares remain, upon exercise of the warrants, which warrants may be exercised in connection with a stock offering in April, 1959. Proceeds will be used to retire bank note indebtedness of \$100,000 for the purchase of additional machinery, equipment and facilities to expand the company's system testing and engineering capabilities.



United Research Corporation of Marlo Park, a subsidiary of United Aircraft Corporation, announces it has changed its name to

UNITED TECHNOLOGY CORPORATION

Objectives of this company have evolved to encompass not only research but also development work in the fields of solid and liquid propellants through complete qualification of rockets and of advanced propulsion systems.

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Concentration of two multi-million dollar permanent facilities to implement the objectives of the corporation is now underway. A Research and Engineering Center is being built on a 25-acre site in Sunnyvale, a Development and Test Center in the Southlake some 10 miles northeast of San Jose, California, is the prime living area of the San Francisco Peninsula.

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New Kinetics transmits battery power automatically in space craft



The satellite, deep-space probe or extended space flights, it is frequently necessary to switch from an exhausted battery to a fresh one or to solar power. Now Kinetics Corporation has combined an ultra-reliable switch with a voltage-sensing circuit to meet this critical requirement. The new Kinetics switch is made simple. It is more rugged and reliable than other designs and is insensitive to shock and vibration.

The switch exhibits no momentary chatter over the whole voltage spectrum, from 5 to 1800 volts, 40-250 Volts per second typical switch times are less than 10 milliseconds at 20 volts. No power is required to hold the switch open or closed. High density semiconductor provides as many as 20 circuits in less than 14 volts. An ultra-sensitive electronic circuit measures battery voltage. When the second voltage falls to a preset level, the circuit passes current to the

switch motor, causing power transfer. It may be applied in systems where a switch is required to transfer battery power after shock or an overload power. After launch, when the satellite is in flight and the first battery is discharged, the same switch can transfer the load to a fresh battery or to solar cell power. For systems employing more than two batteries, additional switches can be utilized for programmed or automatic power change overs.

For any switch application where electronic dependability under tough environmental conditions is essential, use the Kinetics Corporation, Dept. K-10, 415 S. Collins Avenue, Suite 200, San Jose, Calif. 95128. L-3111

KINETICS
CORPORATION



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to provide additional working capital to finance government and other contracts, to finance the serial investments on land for a future plant site, balance for general corporate purposes.

General Instrument Corp., Norwalk, Ct., engaged in the manufacture of electronic components and end products. Offering is 200,000 shares of common stock for public sale, offering price and underwriting terms to be supplied by underwriter. Dollars will be used to repay \$3,000,000 of bank borrowings. Balance will be added to working capital.

Magnagay Corp., North Hollywood, Calif., engaged in the manufacture and sale of electronic equipment and related precision products. Offering is 700,000 shares of capital stock, for public sale at \$1 per share. Proceeds will be used to repay various loans, the expansion of laboratory facilities and provision for research and development to increase plant production facilities, etc.

Universal - Cycles Steel Corp., Bridgeville, Pa., engaged in the production of specialty steel. Offering is 200,000 shares of common capital stock for public sale offering price and underwriting terms to be supplied by underwriter. Dollars will be added to the company's current funds which will be used in working for future plant expansion and improvements.

Riddle Last-Quarter Loss Down From 1958

Winthrop-Riddle Aircraft Inc., under new management since October reported net losses for the last three months of 1959 were \$47,353 as compared with a net loss of \$447,120 for the same period of 1958.

A composite audit and last statement issued by the owner shows that Riddle's scheduled flight and other operations produced revenues of \$1,577,079 for the year as compared with operating revenues of \$2,926,460 including \$810,675 realized from sales. Logic contracts during the fourth quarter of 1958.

Expansion of the company's military contract last year was reflected in the fourth quarter figures which revealed a drop in revenue sales from 2,828,475 for the 1958 fourth quarter to only 1,243,991 for the last three months of 1959. Available for sale aircraft held in the year ended dropped from 19 to 11 units to 8.5 million.

Operating expenses of the owner, reflecting both a reduction in available ton miles offered and tighter cost control methods, reduced Riddle's overall expenses from a total of \$2,042,773

in the fourth quarter of 1958 to \$1,741,185 at the same period of last year. So a change in company stockholders, President Robert M. Hewitt pointed out that Riddle hopes to had successfully on Logic contracts that will be increased by the military by July 1. He estimated that if the owner had retained its Logic contracts through last year, Riddle would have earned a net profit for the fourth quarter of between \$150,000 and \$200,000.

Acquisitions And Mergers

Consolidated Diesel Electric Corp. has acquired control of Utahvac, Inc., Albuquerque, N. M., producer of gas-turbine engines, through a stock transaction.

Bowling Instrument Corp., Ft. Worth, Ind., has acquired Applied Dynamics, Ann Arbor, Mich., manufacturer in the computer field, and will operate the acquisition as an independent company.

Jones, Inc., Cambridge, Mass., has purchased all assets of Alconics Associates, Laconia, N.H., and will operate the electrical equipment manufacturing company as a division. Jones was Alconics' sole distributor power supply in its mechanical electrical machine plants for drafting bench work.

Tedes, Inc., St. Paul, Minn., has acquired a 21% interest in Electro Logic Corp., Vienna, Calif., producer of digitalizing instrument and other instruments.

H. K. Flator & Co. S. A., international subsidiary of H. K. Flator Co., Pittsburgh, has acquired 51% of the stock of King Aircraft Corp., Ltd., Glasgow, Scotland, supplier of aircraft engine and engine components including turbines, pumps and compressors.

Financial Briefs

Cosco Aircraft's recently purchased aircraft interest in French aircraft builder MSA Helote (AW Feb. 15, p. 35) amounts to 49%. Cosco's European sales operations will continue to operate under its present name while Helote, under license agreements, will handle an European manufacturing. If Cosco decides to build the MSA Helote Super Bonanza motor bus in the U.S., the company will have to build a new plant under license in Connecticut. Contracted funds of U.S. license rights for all Turboprop engines.

Aeromex Metal Products Co. set in place for the year ended Dec. 31 was \$4,358,992 or \$1.40 a share as against

of 1,777,777 common shares compared with 1958 earnings of \$3,467,522 or \$1.21 a share on a basis of 1,518,825 common shares outstanding. Sales in 1959 totaled \$17,535,335 compared with 1958 net sales of \$44,997,961.

If Goodrich Co. net sales for 1959 totaled \$771,881,342, an increase of 30.7% over 1958 sales of \$597,296,350. Net earnings for 1959 were \$17,143,146 at \$4.18 a share, compared with \$51,457,421 or \$3.95 a share the year before.

Spent Carbon Co., St. Marys, Pa., reported record net sales of \$2,325,268 for 1959. Sales for the previous year were \$48,518,999. Net income of the company, which manufactures carbon, graphite and ceramic products and electronic components for the nuclear, electrical, chemical, metallurgical, nuclear and electronic industries was \$1,970,817 or \$2.20 a share compared for 1958, compared with \$1,176,654 or \$1.30 a common share in 1958.

North American Aviation experts in earned \$1 billion in sales at Ford 1959. J. H. Rindfleisch, board chairman, led at the company's annual meeting. The company had sales of more than \$1 billion in 1959 and 1957. Current backlog, however, has dropped to \$495 million, from \$765 million a year ago. In the first fiscal year 41% of North American's sales were from missiles, electronic/thermal and electronic products, order engines, nuclear reactors and architectural materials compared with 51% in the previous year.

Thompson Radio Worldwide sales for the year ended Dec. 31 totaled a record \$417,745,913 compared with \$346,612,707 in 1958. Total sales in the radio, space and electronics field were \$716,161,040, an 18% increase over the 1958 figure of \$603,342,680. Net income in 1959 was \$9,745,918 or \$1.01 a share on \$1,181,335 common shares, compared with \$68,791,212 at \$2.36 a share on 1,245,451 shares in 1958.

O. K. Electronics Corp. is merging with Thermal Control, Inc. The companies, both of New York, N. Y., will operate under the name Thermal Control, manufacturing thermal time delay units, high vacuum furnaces and other thermal devices.

Garrett Corp. sales for the half year ended Dec. 31 totaled a record \$107,534,000 compared with \$81,777,000 on Dec. 31, 1958. Net earnings were \$3,761,000 compared with \$2,241,000 for the previous year and half. Garrett has formed a subsidiary company, Garrett (India) Ltd.

FAA Evaluating Variety of Landing Aids

Atlantic City, N. J.—Federal Aviation Agency is moving rapidly toward its goal of an all-weather landing system through round-the-clock testing of run way and approach area hardware at the National Aviation Facilities Experimentation Center here.

of vocal glide slope rate and five non-vocalizing subjects. Center project officers hope they will make a significant contribution toward elimination of such hazards as the "black hole" at touchdown in both day and night weather.

Pilot comments on the various leading and component countries are being compiled primarily on the basis of questionnaires filled in by each partner first, and the experimental center expects to submit an interim report on the status of the program to IAEA's Bureau of Research and Development within the next few weeks.

that they will not be controls and that they will fit into an all-author landing system that will still rely heavily upon radar. ILS systems and some automatic landing systems also undergoing tests at the center. Project officials point out that such items as the visual glide slope indicators being tested could prove valuable as backup reference to ILS systems or could provide the first precision landing aid at small airports having neither ILS nor code airports.

Using a Configuration A approach like written, NAFEX's 10,000 ft HLS survey is equipped to test the following survey objectives:

- Fluorescent runway edge floodlights
- Incandescent runway edge floodlights checked for maintenance this month
- Three configurations of runway edge

- **Catwalk runway and terrain lights**—Installed along the sides of the first 1,000 ft. of runway, are several systems of visual glide path aids which generally work on the principle of aligning different colors of light to create with a glide slope angle of 2.5 deg. These include:

- * Tallish, using yellow, green and red light
- * Andies, including green and under
- * Red and white, also known as the

- Double Bar with amber and white felt

- Minor system with amber and green similar to the old system used on air craft parts.

During a series of lunch and go landings made in almost ideal weather and cleared by Aviation Week, the gooseland induced entrapment for runway incursions, all of which were easily identified from an altitude of about 1,500 ft. As a result, the

Four males. Narrow eyes, obvious, dorsal fins a particularly clear touch down target, with the oak, problems ex-

light intensities. NAITC feels more extensive evaluation will be needed to bring it to a light level acceptable to a majority of users.

continuous bar of light along the runway edge, added in softening the touch-down run from a distance, but the system has the disadvantage of a constant brilliance that cannot be controlled during critical touch-down. NAEBC plans to test a more useful run that mainly with controllable events home of each runway.

Various types of nature gear systems tested seem to function equally well on a cost-comparison basis, and the final decision on which system should be adopted depends primarily on the cost of installation.

Systems installed at NAFEC are similar to that that consist of a series of lights strung in two lines flanking the coastline of the runway and spaced 100 ft apart for a distance of 2,000 ft from the threshold. Spacing between the two parallel series of bars has been changed for runways of 35, 40 and 60 ft, divided by the runway coastline light

Installed in the different design zones, these include the Ellice fish-mounted type-listed log over the Air Force at Dow, AFB, Mich. and March AFB, Calif., and vessels installed at New York International Airport (AD Fig. 78, p. 87)—mostly MIG-2 some fish units and a non-fish pendant light system, which also is used for runway centerline guidance and on high speed runways.

Rough construction of the Ellice manufactured by Structural Concrete Products Corp., is well suited for loading areas which must handle heavy, awkward loads such as the Boeing B-52 jet air-craft used at Dow Airfb, Mo., or the new commercial jet transports landing at Inland. But IWA estimates indicate the cost of installing these might be prohibitive at many airports. Bureau of Research and Development estimates the cost of installing each Ellice for NAFAC was about \$1,700.

FMA figures indicate that the seat-belt fitting configuration can be duplicated with MC-2 seatbelts lights made by the Multi Electric Corp. at a cost as low as \$100 per unit. Designed to Air Force specifications, the MC-2 is basically an 18 in. deep steel can containing a suspended lamp cluster through a screen lens.

From the standpoint of both installation and maintenance costs, the General Electric pneumatic fixture appears most economical. FAA estimates a complete installation cost per seat of \$180 for this type.

Installation requires only the drilling of a one-inch screw for the panel.

sub deep trench running along the runway surface. That piece and most trenches we have asked to the concrete with a special epoxy or bonding agent. Penetration bulbs shows from beneath a heavy metal strap that anchors over the top of the nut and which is placed with two screws for easy replacement. FAA reports that NALC maintenance crews have been able to replace bulbs at the rate of 70 units per hour because of the bulb's simplicity of construction.

Procedures now being used by NAFPC are equipped with 45, 25 and 10 watt bulbs which TAA research direction may soon be replaced with 200 watt high-intensity bulbs to provide better illumination. TAA tests indicate that the quartz type bulbs used in the past can be seen between 500 and 1,000 ft. away in daylight conditions with one inch-thick of a milk residue. A 60% exposure of the bulbs is estimated at 1,000 ft. at full power.

Among the visual aids, the most easily identified and followed in the manual intervention appear to be the red and white, and the double bar system. Now being used at London Airport and by the Royal Air Force at Farnborough, England, the red and white works in much the same manner as a gun light camera projecting two colors of light which the pilot must use judiciously in order to remain on the correct glide slope.

Basic unit of the unitize contains three layers of 20,000 configurations each, with a red filter over their top halves. They are arranged in the row of a tubular steel cradle, with the light rays shining through a forward spectral slit of about one inch. Units 8 and 9 are in sets of three spaced 22 ft. apart.

Convergent alignment with the horizon requires that the pilot see white in the front work and red in the rear at an altitude of about 1200 ft. A clearance of 4 ft. on from threshold is, in practice, the shortest to be observed at an angle which will show two distinct colors at the same time. Discard below the proper glide path angle shows only white, light, when an angle which could lead to an overclosure of the touch down area shows only red. Changing hue of the colors during descent points with a visual reference to judge the degree of necessary glide slope angle.

The Double Day system uses the principle of lining up two separate colors into one level combination of color and white colors. Lights installed along Roomer 13-31 are socket beam types of 300 watt power each.

**Which of these
Craig skills and
services
can help you?**

- ▶ **Instant Travel** — 24/7 flights, hotel, car rental, insurance, transfers, visas and tickets
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spot and mounted on 25.5 ft high poles back each side of the runway at a distance of 130 ft from the edge. A second battery of amber lights, on a level with the runway and in two groups of five each, back the runway 500 ft further down from the threshold. Total effect of the combination is that the white light bar can literally be used in the manner of an artificial horizon by simply keeping it in level alignment with the flanking amber color bar. Perfect coordination with the 7.5 deg glide slope angle, presents a solid color bar of white/black/amber while an observer's angle reveals a white line above the amber.

The amber sector is located 1,900 ft from threshold on the left side of the runway. At this point, two light series of seven 200 watt sealed beam units equipped with green filters are mounted in an inch-high wooden frame installed parallel to each color and about 30 ft apart. Seven amber lights down the runway is a four inch-high wooden frame with four amber lights arranged in the form of a square. Proper light alignment with the white requires a color case of an amber dot, or "mushball" in the lingo is indicated, in the middle of a green band. Approach shows correct glide slope angle; places the amber dot above the green bar. The full pattern appears as a large green ball at a great distance during the light aligned by Avionics Writ, and, without, of the forward green light made it difficult to obtain the position of the amber color.

Color Combination

A combination of red, green and amber color is used in the white runway, based in two feet high metal stands on each side of the runway (1,900 ft from the threshold) back stand contains an 18-in-high projector with a five inch lens opening and a small electric motor which operates a flapper shutter at the rate of one movement a second. Stand mounted to the left of the runway, has long angles one half a degree higher than the rest on the right to give the pilot a method of double checking his glide slope angle. If the runway lighting is above the correct angle both lamps appear amber, if it is low, the lamps are red with the left and turning the color fan. Correct glide slope angle with no deviation produces a green color reading from both units.

Red visual glide path and system indicating correct level and elevation at NATEC is the major critical factor in the view used on runway corners. About 1,000 ft down the left side of the runway from the threshold, center technique has installed a horizontal battery of eight center-orientated lights mounted on a ground level concrete

AIRIAL view of experimental approach lighting system in test from 500 ft.



STANDARD Configuration A light system is indicated with NCT sensor gap lighting. Related by Runways at threshold area.

base. About 10 ft distant, mounted in the back of a track, is a mirror measuring four feet long and three feet wide.

Extending from each side of the track are horizontal line of six green lights each. Ground positioned lights are focused into the mirror so that an amber colored band appears to center itself in the middle of a green bar when correct glide slope angle is being maintained.

WHO'S WHERE

(Continued from page 23)

Changes

William J. Conroy, Jr., manager of finance and business planning, General Electric Co.'s Machine and Space Vehicle Department, Philadelphia, Pa. Also Edward A. Miller, manager of the Development group in the Machine and Space Vehicle Department.

Robert C. Little, assistant manager of customer service for Air Force aircraft, McDonnell Aircraft Corp., St. Louis, Mo. Will Ross S. Ross, secretary Mr. Little as chief test pilot and chief of flight operations.

Frank R. Carroll, general manager of test systems, Systems Products Division of E. F. Goodrich Co., Irvine, Calif.

Barry W. Schmitt, director of marketing, E. H. Phillips, Inc., Fort Worth, Calif.

James W. Schmitt, director of development, development group, Instrument Division of Boeing Inc., Everett, Calif. Also Stephen H. Hickey, senior and technical support for the Instrument Division.

William C. Hume, director of test support, Aircraft Division, Chrysler Corp., Detroit, Mich.

Stan Bena, director of Engineering, General Support Division, American Filter Corp., Inc., St. Louis, Mo.

Robert F. Williams, technical director, Military Programs Division, Allen B. DuMont Laboratories, Inc., Clifton, N. J. The division has also appointed the following chief systems engineers: Paul Hensel, instrumentation systems; Richard Felschowsky, data and display systems; John De Bell, test systems; William Conroy, support systems; Charles Swenson, communications systems.

Robert G. Brown, director, Advanced Concept Research and Development, AGARD, Air Division of General Motors, Warrendale, Pa. Also John E. Shuler, head of a new group in development and production in internal heating subsystem for aircraft.

Solomon Chapp, manager of research and control systems equipment, General Electric Co.'s Machine and Space Vehicle Department, Philadelphia, Pa.

H. G. McKinnon, director of research, Lockheed Aircraft, Inc., Burbank, Calif.

Michael Shapiro, international sales manager, General Electric Co., Los Angeles.

Edith Shulman, manager of systems and instrumentation for the Air Force, Los Angeles, Calif. Also John E. Shuler, head of a new group in development and production in internal heating subsystem for aircraft.

H. G. McKinnon, director of research, Lockheed Aircraft, Inc., Burbank, Calif.

Edith Shulman, manager of systems and instrumentation for the Air Force, Los Angeles, Calif.

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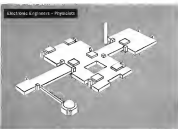
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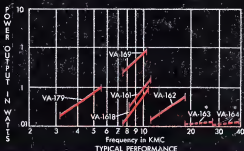
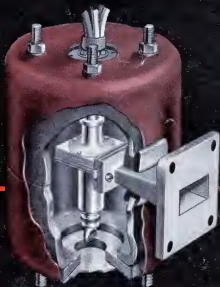
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